B.Sc. (FORESTRY)

SEMESTER - I

Course Code	Title of the course	Credit
GPT-301	Moral & Value Education	2 (2+0)
LNG-304	Professional Communication and Technical Writing	3 (3+0)
PSY-302	Human Development, Professional Ethics & Personality Development	2 (2+0)
STFB-311	Principles and practices of Silviculture	3 (2+1)
STFB-312	Forest Ecology, Biodiversity & Conservation	3 (2+1)
STFB-313	Cytology & Genetics	3 (2+1)
BCBE-302	Introductory Biochemistry	3 (2+1)
MAS-303	Mathematics - I (Deficiency-Bio)	2 (2+0)
AGFO-311	Introduction to Tree Science (Deficiency-Maths)	2 (2+0)
CSIT-301	Introduction to Computer Application	2 (1+1)
PED-303	Physical Education	NC
	Total Credits	**23 (18+5)**

SEMESTER - II

Course Code	Title of the course	Credits
STFB-321	Introduction to Forest Mensuration	3 (2+1)
MAS-304	Mathematics - II	2 (2+0)
ENVS-415	Environmental Studies- I	2 (2+0)
SAC-406	Introduction to Forest Soils Science & Geology	2 (1+1)
STFB-322	Dendrology	2 (1+1)
AEAB-310	Principles of Forest Economics	3 (2+1)
CE-310	Surveying and Leveling	3 (2+1)
EXT-304	Fundamentals of Extension Education & Community Development	2 (1+1)
STFB-323	Tree Seed Technology	3(2+1)
ENVS-322	Agrometeorology	3 (2+1)
	Total Credits	**25 (17+8)**

SEMESTER – III

Course Code	Title of the course	Credits
STFB-411	Forest Management & Working Plan	3 (2+1)
STFB-412	Silvicultural Systems	3 (3+0)
STFB-413	Forest Entomology and Pest management	3 (2+1)
LPM-425	Livestock Management	3 (2+1)
SAC-407	Fertility of Forest Soils & Nutrient Management	3 (2+1)
MBFT-414	General & Forest Microbiology	3 (2+1)
AGFO-411	Introduction to Medicinal and Aromatic Plants	3 (2+1)
STFB-414	Wood Anatomy	3 (2+1)
STFB-415	Applied Forest Mensuration	3 (2+1)
…….	NSS/NCC	NC
	Total Credits	**27 (19+8)**

SEMESTER - IV

Course Code	Title of the course	Credits
ENVS-416	Environmental Studies II	2 (2+0)
AGFO-421	Introduction to Agroforestry	3 (2+1)
AEAB-410	Forest marketing and financial management	3 (2+1)
STFB-421	Silviculture of Indian Trees	3 (2+1)
STFB-422	Fundamentals of Wildlife & Forest Tribes	3 (2+1)
STFB-423	Wood Science & Technology	3 (2+1)
SAC-508	Forest Soil Survey, Land Use & Remote Sensing	3 (2+1)
STFB-424	Nursery Management and Seedling Production	2 (1+1)
MAS-540	Agricultural Statistics	3 (2+1)
	Total Credits	**25 (17+8)**

SEMESTER - V

Course Code	Title of the course	Credits
AGFO-511	Forest Utilization - I (Timber & Forest Products)	3 (2+1)
STFB-511	Wildlife Management & Biosphere	3 (2+1)
STFB-512	Tree Improvement	3 (2+1)
STFB-513	Wood Seasoning and Preservation	3 (2+1)
STFB-514	Tree Physiology	3 (2+1)
STFB-515	Forest Pathology & Disease Management	3 (2+1)
AGFO-512	Commercial Forestry	2 (1+1)
STFB-516	Logging & Ergonomics	3 (2+1)
AGRN-513	Introduction to Major Field Crops	3(2+1)
	Total Credits	**26 (17+9)**

SEMESTER - VI

Course Code	Title of the course	Credits
AGFO-521	Forest Utilization – II (Non-Timber Forest Products)	3 (2+1)
STFB-521	Forest Policy and legislation	3 (3+0)
STFB-522	Plantation Forestry	3 (2+1)
STFB-523	Forest Biotechnology	3 (2+1)
AEAB-510	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)
AGFO-522	Rangeland Management	3 (2+1)
AGFO-523	Social Forestry and Joint Forest Management	2 (2+0)
ENVS-521	Agricultural Disaster Management	2 (2+0)
	Total Credits	**28 (21+7)**

SEMESTER – VII

(Experimental Learning/Hands on Training)

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

Course Code	**Title**	**Credits**
STFB-611	Production and Marketing of Quality Planting Material	20 (0+20)
STFB-612	Cultivation and Processing of Medicinal Plants	20 (0+20)
ENVS-610	Natural Resource Management	20 (0+20)
	Total Credits	**20 (0+20)**

SEMESTER – VIII

(Multidisciplinary Courses / Vocational Training)

Course Code	**Title**	**Credits**
STFB-621	Forest Project /Industrial Placement / Institutional Attachment	15(0+15)
STFB-522	Study Tour	8 (0+8)
AGFO-621	Forestry Work Experience	6 (0+8)
	Total Credits	**29 (0+29)**

Total Credits (Semester I to VIII) (23+25+27+25+26+28+20+29) = 203

SEMESTER – I

Course Title: Moral & Value EducationCourse Code: GPT-301Credit hours ; 2(2+0)
Now this is eternal Life: that they know you, the only true God, and Jesus Christ, whom you have sent. John 17:13

SHIATS is a Christian Minority Institution declared Deemed University under Article 30 (I) of the constitution of India; and it has about 9,000 student, nine distinct faculties with close to 1200 staff members, a host of international links and cooperative programmes, and full accreditation by various Statutory bodies, Besides agricultural sciences the University has expanded over the last twenty years and presently has a side variety of disciplines in Science, Humanities, Media, Health, Veterinary Sciences, Education, Business Engineering and Theology. This university is dedicated to the vision and mission of its founder Dr. Sam Higginbottom; Feed the Hungry, Serve the Land; Gospel and Plough. Yeshu Darbar (A Royal Court of Jesus) is held every day and is a great blessing for thousands of people who gather to hear the word of God and ask for Christ's blessing. Staff & Students often go through personal, social, cultural, emotional and spiritual problems while dealing with usual pressures along with the perplexities of university life. The benefits of talking with a trained counselor under such situation cannot be undermined. We believe that every individual is created in the image and likeness of God and belongs to God. One prime function of the Directorate of Chaplaincy, Guidance & Counseling will be to provide effective help when a member of the university family is in need to the same or seeks its. Though the Directorate shall be responsible for counselling to anyone facing such problem, but particularly help the Staff, students and families on campus of the University. Directorate will be equipped with facilities/space/faculty needed for the purpose. There would be sufficient number of trained counselors to do the counseling work in each faculty/college/department.

Objectives:

1. To impart to the student the teaching of Moral & Values
2. To equip the students to be a better and responsible citizens.
3. To build the character and develop the leadership skills.
4. To inculcate purpose driven life among staff and students by catering their spiritual needs.

Course Outline

- **Addiction**: Introduction to addiction: types of addictions; causes of addiction; harmful effects of addiction; remedies – Luke 15:11-32
- **Alertness**: Importance of alertness; taking precautions; promptness in work; preventions handling situation ; identifying crisis; administrative skill – Luke 12:35-24
- **Temptation & Choice Making**: Types of temptation setting goals in life; decision making; priorities of life; youth and career; risk- Matthew 13:47-50 & Luke 14:16-24
- **Contentment: Wealth and Worries:** Definition of contentment; contentment in postmodern world; source of contentment; need of contentment; greed and wants; attaining statehood of contentment; man, money and pleasure; prosperity and materialism; consumerism; globalization; privatization; urbanization; modernialism; ecological crisis; social evils; fear and anxiety; death and future hope-Matthew 19:16-30 & Luke 12:22-34; MRRHWQ 20:1-6
- **Corruption and Violence** : Etymology of corruption; nature and cause of corruption; effects and result of corruption; areas of corruption; corrupt systems; relationship between second law of thermodynamics and corruption; violence: a cause of corruption; steps of eradicate corruption- Luke 16:1-8

- **Deception & Hypocrisy:** Meaning od deception; reasons of deception; forms of deception; motives of deception; detection of deception; deception and society; truth; awareness from deception; false teachers; consequences of hypocrisy and remedies- Matthew 13:33 & Luke 13:20-21; Matthew 9:16-17& Mark 2:21-22
- **Depression and Happiness:** Meaning areas; effects; fear, guilt and anxiety; consequences; remedies; identification and handling depression; suicide and preventive measures
- **Discipline & Obedience:** Need of discipline and commitment; impact of discipline and commitment; important quotes; reward of obedience and hard work; lives of disciplined personalities such as Joseph, Daniel, Jesus Christ; Obedience: A backbone of discipline and commitment- Luke 14:28-33; Luke 17:7-10& Matthew 21:28-31
- **God, Sin and Salvation:** Biblical Perspective: Concept of God; attributes of God; triune man; concept of creation; sin and suffering; purpose of salvation and means to attain the same; Resurrection & Occultism
- **Humanity:** Human nature and behavior; mark of good citizen; compassion; care for God's creation; love hate relationship; Gospel and Plough; Life sketch of Dr. Sam Higginbottom and Mother Teresa and their contribution towards the nation- Luke 10:30-37
- **Kindness & Cruelty:** Humility and Pride: Nature and behavior of cruelty; effect and repercussion of cruelty; laws against cruelty; kindness and forgiveness; strife for harmony and peace; arrogance; anthropocentrism; consequences of pride and selfishness; restlessness; reward of humility; aspects of humility; fruits of the Holy spirit-Luke 18:10; Luke 12:16-21; Luke 16:19-31: Luke 7:41-43; Matthew 18:23-34; Galatians 5:21-23
- **Leadership:** Meaning and definition of leadership; qualities of a good leaer; components of leadership; leadership and its impact; excellence and mediocrity; failure and success; integrity and leadership; social responsible; integrity in the book of Proverbs; ethics and honesty; quotes on integrity; stewardship, money and accountability- Luke12:42-48; Mark 12:13-17; Mathew 5:14-15
- **Love, Marriage & Relationship:** Meaning and understanding of love; types of love; lust and nudity; love and relationship; divine basis of love; understanding marriage in present context; types of marriages; homosexuality and lesbianism; live-in-relationship; foundation of marriage; divorce; domestic violence-1
  Corinth 13; Mathew 22:34-40, Matthew 22:L2-14 & John 15:1-217
- **Moral Values:** Introduction; aims and objectives; C S Lewis's concept; ethics; respect for life; purpose and meaning of life; meaning of values; values and purpose of life; types of values; laziness; ignorance; meaning and value of time; Ten Commandments- Matthew-25:1-13 Matthew 13:44-46; Luke 15:8-10 & Luke 15:3; Matthew 57; Exodus 20
- **Zeal:** Climbing new heights; perseverance; faith; confidence – Luke 11:5-8 & Luke 18:2-8
- **Personality Development:** Definition, importance; types of approaches; elements and stages of personality development; gossiping and rumors mongering- Matthew 25:14-30 & Luke 19:11-27
- **Prayer Life and Meditation :** Meaning; need; method; types; faith and trusting god; its results; importance; worship; The Lord's Prayers- Matthew 6:5-15
- **Receptivity & Productivity :** Motivation for study; listening; communication skills; planning; programming; implementation; team spirit- Matthew 13:1-8; 18-23
- **Wisdom and Justice- Definition Types**; importance; vanity; justice; book of Proverbs,

Ecclesiastes and James- Matthew 7:24-27

Course: Professional Communication & Tech. Writing

Couse code: LNG 304 **Credit Hours: 3(3-0-0)**

Language:

a. Word enrichment (Antonyms, Synonyms, Homonyms, Homophones, Aeronyms
b. Tenses
c. Concord (Subject, Verb Agreement)
d. Modifiers (Adjectives, Adverbs, Participle)
e. Preposition (Usage)
f. Inflection (Noun, Verb)
g. Determiners (General, Specific)
h. Voice

Communication:

a. Role of Body language in communication
b. Self-introduction
c. Group Discussions
d. Role Plays
e. Interviews
f. To cater different types of audience

Technical writing

a. Resume
b. Curriculum Vitate
c. Letters
d. Memos
e. Report
f. Proposals

g. Usage of graphics

h. Different administrative documents (Notices, Circulars, Memos, Agenda, Minutes)

Speech:

a. Accent

b. Intonation

c. Different types of speeches

d. Delivering of different types of speeches

Books Prescribed

- Gerson, Sharon J. and Gerson, Steven M. Technical – Process and Product, led. 2000, Pearson Education, INC., New Delhi
- Dickson, Grisalda J.S. Higgin's Technical Writing, 2004, Godwin Publication, Allahabad
- Martinet A.V. and Thomson A.J.A. Practical English Grammer J.V. ed, 1986

  Oxford University Press, Delhi

  Agarwal, Malti Krishna's Professional Communication, KRISHNA Prakashan Media (P) Ltd, Meerut

STFB-311 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, and 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. 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. 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 and 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 slope 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
- 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

• 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. 4
• 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.

STFB-312 FOREST ECOLOGY, BIODIVERSITY & CONSERVATION Cr. 3(2+1)

Theory:

Ecology importance & scope. Historical development ecology as a science. Concept of levels of biological organization. Ecosystem – classification, distribution and their importance. Forest environment- Major abiotic and biotic components and their interaction, Nutrient cycling, trophic levels, food chain and food webs, Different types of ecological pyramids and energy flow. Population ecology - definition & their characteristics, population dynamics and carrying capacity, preparation of life table and its importance in forest management. Community ecology – Species interaction, Ecological succession, classification, 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, scope & their importance, levels of study, distribution of diversity in life forms. Hotspots of biodiversity & their importance, 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:

Study of vegetations of the university campus. 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 nearby forest; Study of succession in field and water bodies; Visit to different ecosystems.

Theory

Content	Lecture
• Ecology importance & scope.	1
• Historical development ecology as a science.	2
• Concept of levels of biological organization.	2
• Ecosystem – classification and distribution and their importance.	2
• Forest environment- Major abiotic and biotic components and their interaction,	2
• Nutrient cycling,	2
• Trophic levels, food chain and food webs	2
• Different types of ecological pyramids and energy flow.	2
• Population ecology & their characteristics - definition,	2
• Population dynamics and carrying capacity, preparation of life table and its	2
• Importance in forest management.	1
• Community ecology – Species interaction.	2
• Ecological succession, classification, terminology, basic concepts,	
• Climax vegetation types, Methods to study effects of forest management on succession.	2
• Island Biogeography. Autecology of important tree species.	2
• Biodiversity and conservation & their importance– definition, levels of study, distribution of diversity in life forms,	2
• Hotspots of biodiversity & their importance,	2
• 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. Biosphere concept	2
• Conservation – efforts in India and worldwide.	1

Practical

Content	Lecture
• Study of vegetation of the university campus	1
• Estimating productivity of a site.	3
• Study of microclimate and forest soils.	1
• Study of ecological modifications of leaves.	1
• Study of succession in field and water bodies.	2
• 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 nearby forest.	2
• Visit to different ecosystems.	2

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 SEI 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.
11. Sharma, P. D. Ecology & Environment,Rastogi Publications, Meerut.

STFB-313 CYTOLOGY AND GENETICS Cr. 3(2+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 inhritance, pleiotropy, threshold characters, co-dominance pentrance. 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: Polyploidy, Types of Polyploidy, Auto-polyploidy, Allopolyploids, Characteristics of Polyploidy, Origin of Aneupolyploids: Monosomy : Nullsomic, Trisomic Mitosis and Meiosis: Gametophytic self Incompability: Sporophytic self Incompability: Polygenic and Oligogenic Characters, Genetic Erosion. Components of Genetic Variance, Types of Variance, Genetic Variance, Phenotypic Variance Environmental Variance.

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 pentrance.	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•
Polyploidy, Types of Polyploidy	2
• Auto-polyploidy, Allopolyploids	2
• Characteristics of Polyploidy	1
• Origin of Aneupolyploids	2
•Monosomy	1
• Nullsomic, Trisomic	1
•Mitosis and Meiosis	3
•Gametophytic self Incompability	1
• Sporophytic self Incompability	1
• Polygenic and Oligogenic Characters	2
• Genetic Erosion	1
•Components of Genetic Variance	1
•Types of Variance	1
• Genetic Variance, Phenotypic Variance, Environmental Variance.	2

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 Verleg, 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.
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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.

BCBE-302INTRODUCTORYBIOCHEMISTRYCr. 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 isomerism	3
□	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/cofactorscarbohydrate.	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.

Code MAS 303 **Maths- I**

Credit 2(2-0-0)

Algebra

Theory of quadratic, Binomial-Theorem (for +ve index), Use of natural & common logarithms, exponential series, partial-fractions, Determinants of order 3, Theory of Matrices, addition, subtraction, multiplication, transpose, elementary ideas on ad joint

& inverse. Solution of linear equations, inequalities, permutation & combination.

Trigonometry

Trigonometrical- functions, addition & subtraction formula, double & half angle

formula laws of sines & cosines, solutions of triangles, height & distance, real & complex-numbers, hyperbolic trigonometric functions. De-Movire's Theorem.

Coordinate-Geometry: Distance between two points, Area of triangle, Straight-lines

Reference – Books:

Algebra: Hall & Knight

Trigonometry: S.L. Loney

Coordinate- Geometry: S. L. Loney

AGFO-311 INTRODUCTION TO TREE SCIENCE Cr. 2(2+0)

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-tropica, 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-tropica, 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.

CSIT-301 COMPUTER APPLICATION Cr. 2(1+1)

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, asic 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.	
• 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.	

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

PSY-302 Human Development, Professional Ethics & Personality Development Credit 2(2+0)

1. Personality: Derivation of the term "Personality" tracing the historical background of the definition of Personality .Definition mainly all ports definition, stressing uniqueness, enduring characteristics individuality and interaction with environment.

2. Personality approaches: Psychodynamics (Freud, Junk& Adler), Humanistic approach to Personality: Concept of Guans (Rogers&Maslow), Dipositional approaches-Type (Jung,Type A&B,Rotter and The Big Five Model) and Trait Approaches(Cattell) Behavioral Approaches-Locus of Control and Social Learning theory.

3. Theories of personality, (Psychoanalytic approach, trait approach, learning approaches, social-cognitive approach and humanistic approach).

4. Assesment of personality: Questionnaires, Interviewes, Projective techniques (TAT, Rorschachs Ink Blot Test, Sentence Completion Test), Behavioral assessment, Observation, self-Report measures and case study method.

5. Application: Increasing self efficacy through goal setting, Personality profiles of successful persons of the particular area with the help of case study method.

Reading List (For Professional Ethics):

- Scientific values and professional ethics in agricultural research Jagannndham Challa, Principal Scientist, HRD, NAARM, Rajendranagar, Hyderabad-500030.
- Ethical issues in agricultural research, technology and intellectual property rights- Anil K.Gupta, H.L.Chair professor of Entrepreneurship,Indian Institute of Management,Ahmadabad 380015.

Book for Reading:

1.Feldman ,R.S.(8^{th} ed.)(2008) Understanding psychology.TMH.

2.Zimbardo,P.G.and Weber,A.L.(1997) psychology.N.Y.Pearson.

3. Baron,R.A.(2001), psychology,New Delhi: Pearson Education Pvt.Ltd.

4.Morgon,King ,Weiss and Schopler Introduction to psychology,VII edition,(1989) McGraw Hill,India.

SEMESTER - II

STFB-321 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, F.P.S. System and C.G.S. System 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. Relation between girth and diameter 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, Abney's level, Topographical Abney's level Advantage and disadvantages. Form, form factors. E rrors in height measurement.

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.

Content

Lecture

o Int

roduction, definition, objectives and scope of forest mensuration. 2

- Sc ales of measurement (nominal, ordinal, interval and ratio scale). Units of 2
- Measurement, standards of accuracy implied in their expression. 2
- Measurement of single tree - objectives, standard rules governing 2
- Measurement at breast height. 2
- Me asurement of tree diameter and girth using rulers, callipers and tapes. 3
- Comparison between tape and calliper measurements. 1
- Measurements of upper stem diameter and instruments such as Ruler, Finish 2
- Parabolic Calliper, Relaskop, Pentaprism. 2
- Bark measurements - objectives, thickness, surface area and volume. 2
- Crown measurements - objectives, diameter, height, surface area and volume. 3
- Height measurements - direct and indirect methods. Height measurement 3
- Employing geometric and trigonometric principles 2
- Height measuring instruments, errors in height measurement. 3

Practical

Content	Lecture
Units of measurement and their uses.	1
Instruments used in forest mensuration	2
working principles of Instrument,	2
tree height measurement,	1
tree height measurement by Ravi altimeter	1
tree height measurement by Abneys level	1
tree height measurement by tangent menth1od	1
tree diameter measurement ,	1
basal area	1,
bark thickness	1
and crown measurements.	1

References

1. Chaturvedi, A.N. and L.S. Kanna. 1982. A handbook on Forest Mensuration. International Book Distributors
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

Mathematics- II

Code MAS 304 **Credit 2(2-0-0)**

Real numbers, coordinate line & planes, straight lines, function.Limits, properties, derivatives, differentiation of sine & cosine, continuity, properties of continuous functions, differentiation of algebraic, trigonometric, logarithmic & exponential functions, product of functions, function of a function.Derivative as a rate change, maxima & minima of a single variable. Integral of a real function, integration by substitution, integral of trigonometric & Transcendental function.Vector in a plane, vector function, sum & difference of vectors of vectors, dot & cross-product.

Reference- Books

Differential –Calculus: Gorakh-Prasad

Integral- Calculus : Gorakh-Prasad

ENVS-321 ENVIRONMENTAL STUDIES - I Cr. 2(2+0)

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.
3. Srivastava, S. Environmental Studies 2007. S. K. Kataria and Sons, New Delhi 110006
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 volumepedologyrocks- types- Igneous-sedimentary and metamorphic-classification-soil forming minerals definition- classification-silicates-oxides carbonates - sulphides - phosphatesoccurrence. Weathering of rocks and minerals-weathering factors-physical-chemical-biological agents involved, weathering indices-factors of soil formation, land formsparent 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 caloroimetric 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	1

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. 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 caloroimetric 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
4. Biswas, T.D. and S.K. Mukherjee, 1992. Text book soil fertility. Tata Mc. Grew Hill, Publishning Co., New Delhi.

5. Black, C.A. 1993. Soil fertility evaluation and control, Lewis publishers, London. fertilisers 5th edition Macmillan Publishing Co., New York.
6. Kanwar, J.S. 1976. Soil Fertility - Theory and practice ICAR publication, New Delhi.
7. Wild, A. 1988. Soil conditions and plant growth. 11th edition, ELBS, London.
8. Allison, F.C. 1973. Soil organic matter and its role in crop production. Elsevier Scientific Publishing Co., Amsterdam.
9. Richard F. Fisher and Dan Binkley. 2000. Ecology and management of forest soils. III edn. John Wiley & Sons, Inc.
10. Stevenson, F.J. 1982. Humus chemistry: genesis, composition, reactions. John Wiley and Sons, New York.

STFB-322 DENDROLOGY Cr. 2(1+1)

Theory

Introduction - importance and scope of dendrology, Morphology of woody plants andrangevof 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. Morpholog 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, Guttifereae and Liliaceae; Moraceae and Poaceae; Meliaceae, Elaeagnaceae and Salicaceae; Legumenosae and Apocynaceae; Combretaceae, Lythraceae, Myrtaceae and Santaleceae; Asteraceae, Ebenanceae, 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. Morpholog 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, Ebenanceae	3
• Study of woody flora of: Sapotaceae and Verbenaceae; Euphorbiaceae, Pinaceae, Cupressaceae, Taxaceae.	3

References

1. Shiva, M.P. A Handbook of Systematic Botany, 1986.IBD Publisher, Dehradun.
2. Luna, R.K. 1988. Plantation Forestry In India. International Book

Distributors, Dehradun. p 476.
3. Luna, R.K. Plantation Trees. International Book Distributors, Dehradun.
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

AEAB-310 PRINCIPLES OF FOREST ECONOMICS Cr. 3(2+1)

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 low 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 - Low of Diminishing Magginal Returns Returns . Cost concepts Law of Supply- supply schedule and curve -elasticized market equilibrium. Distribution -theories of rent, wage interest and profit. National income - Seetoral 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.

- 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 low 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 - Low of Diminishing Magginal Returns Returns .
- Cost concepts Law of Supply- supply schedule and curve -elasticized market equilibrium. Distribution - theories of rent, wage interest and profit.
- National income - Seetoral 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.

Practical

Content	Lecture
Exercise on survey of forest products	2
Cost analysis of tree plantation	2
Study different agencies involve in marketing of forest products	2
Study demand and supply of forest and non – timber forest products in local area	2
Exercise of cost of production of forest tree raising in Forestry research, SHIATS nursery	2

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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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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 - Organizational 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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STFB-323 TREE SEED TECHNOLOGY Cr. 3(2+1)

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. Important Tree and Families bearing Seeds: Morphology of Fruit and Seed; Development and maturation of seed bearing organs and seeds; Mass Blooming, Staggered Blooming, Episodic Blooming, Difference between reproductive cycles of gymnosperms and angiosperms; Mode of dispersal of forest seeds; seasonality and periodicity of flowering and Fruiting; External Factors influencing seed Production; Genetic Implication of Seed Handling; Seed Documentation; Seed Sources Record, Seed handling Record, Seed Testing Record, Seed stock and dispatch record.

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 rouging.	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
• Important Tree and Families bearing Seeds	1
• Morphology of Fruit and Seed	2
• Development and maturation of seed bearing organs and seeds	2
• Mass Blooming, Staggered Blooming, Episodic Blooming	1
• Difference between reproductive cycles of gymnosperms and angiosperms	2
• Mode of dispersal of forest seeds	2
• Seasonality and periodicity of flowering and Fruiting	2
• External Factors influencing seed Production	2
• Genetic Implication of Seed Handling	2
• Seed Documentation	1
• Seed Sources Record	1
• Seed handling Record	1
• Seed Testing Record	1
• Seed stock and dispatch record	2

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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ENVS-322 AGROMETEOROLOGY Cr. 3 (2+1)

Meaning and scope of agricultural meteorology; Weather and climate, climatic controls, micro-climate, weather elements. Earth's atmosphere: composition and structure; Solar radiation, solar constant, radiation budget and laws of radiation; Atmospheric temperature, factors affecting horizontal and vertical temperature distribution, Global warming; Atmospheric pressure: distribution and pressure belts, Isobars; Wind: general circulation, planetary and local winds, cyclones, anticyclones, trough and ridge; Atmospheric humidity, vapour pressure; Evaporation, transpiration and evapotranspiration; Condensation: process and types; Forms of precipitation: rain, drizzle, snow, rime, sleet, glaze and hail; Formation and classification of clouds and cloud seeding; Introduction to Indian monsoon; weather forecasting, its application to agriculture and agro advisory services.
Practical: Site selection for Agromet observatory; Layout plan of Agromet observatory (Agromet field unit); Measurement of soil temperature; Measurement of grass minimum temperature, Measurement of rainfall; Measurement of evaporation; Measurement of atmospheric pressure; Measurement of sunshine duration; Measurement of wind direction; Measurement of wind speed; Measurement of cloud amount; Measurement of air temperature; Measurement of relative humidity and measurement of dew.

Theory

Content	Lecture
• Meaning and scope of agricultural meteorology.	1
• Weather and climate, climatic controls, micro-climate, weather elements.	3
• Earth's atmosphere: Composition and structure.	2
• Solar radiation, solar constant, radiation budget and laws of radiation	3
• Atmospheric temperature, factors affecting horizontal and vertical temperature distribution.	3
• Global warming.	2
• Atmospheric pressure: distribution and pressure belts, Isobars.	2
• Wind: general circulation. planetary and local winds, cyclones, anticyclones, trough and ridge.	3
• Atmospheric humidity, vapour pressure.	3
• Evaporation, transpiration and evapotranspiration.	2
• Condensation: process and types.	2
• Forms of precipitation: rain, drizzle, snow, rime, sleet, glaze and hail.	2
• Formation and classification of clouds and cloud seeding.	2
• Introduction to Indian monsoon.	2
• Weather forecasting , its application to agriculture and agro advisory services	2

Practical

Content	Lecture
• Site selection for Agromet observatory	1
• Layout plan of Agromet observatory (Agromet field unit)	1
• Measurement of soil temperature	1
• Measurement of grass minimum temperature	1
• Measurement of rainfall	1
• Measurement of evaporation	1
• Measurement of atmospheric pressure	1
• Measurement of sunshine duration	1
• Measurement of wind direction	1
• Measurement of wind speed	1
• Measurement of cloud amount	1
• Measurement of air temperature	1
• Measurement of relative humidity	1
Measurement of dew	

SEMESTER - III

STFB-411 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. Even aged 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 – detemination 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 methods 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: scope and 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 –detemination 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

•Technical term related to forest management and working plan---------- 2
• 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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STFB-412 SILVICULTURAL SYSTEMS Cr. 3(3+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. Prunning 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.	3
• Shelterwood system - Uniform system	2
• Group system, Shelterwood strip system	2
• Wedge system, Strip and group system	2
• Irregular shelterwood system, Indian irregular shelterwood system.	3
• 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.	2
• Tending operations - weeding, cleaning, thinnings,	2
• Definitions, objectives and methods, increment felling and improvement felling.	2
• Prunning and lopping.	2
• Control of climbers and undesirable plants.	

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STFB-413 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, legal, biological and chemical.	2
• 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. 3(2+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. Principles of rationing. Milk - definition, composition and nutritive value. Factors affecting quantity and quality of milk. Common diseases and their Control.

Practical

Different tools/instruments used in livestock management; Routine management practices followed on livestock farms; Identification of feedstuffs and their nutritive value; Computation of rations for livestock; Study of housing systems and requirements; Study of dairy farm records; Preservation of fodder as hay andsilage.

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
• Principles of rationing.	1
• Milk - definition, composition and nutritive value.	2
• Factors affecting quantity and quality of milk.	1
•Common diseases and their Control.	6

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
•Methods of administration of drugs	2
• Preservation of fodder as hay and silalge.	2

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

Theory

Forest soils - genesis - soil forming processess - podsolisation and laterization – genetic soil groups of the word - upland podzol - grood soils - melanized - laterite and lateritic, hydromophic 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 applcation -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 processess	2
• Podsolisation and laterization - genetic soil groups of the word - upland podzol - grood soils - melanized	4
• Laterite and lateritic, hydromophic 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 applcation -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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MBFT-414 GENERAL AND FOREST MICROBIOLOGY Cr. 3(2+1)

Theory

Definition and scope of microbiology - spotaneous 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 Microbilogy - scope and signification of Forest Microbilogy -Microbiology - resolving power - numerical aperture, magnification - different types of microbiology and micrometry. Structure and organization of microbil cell : Prokaryotes and Eucaryotes, Various groups of microorganisms - bacteria , Fungi actinomycetes, lgae, protozoa and virous. Methods of isolation and purification . Types of nutrional media - sterilisation - principes of staining microirganisms. Preservation of microbial cultures. Nutritional types: autoroph, heterotroph, phototroph and chemolithotrophs. Requirements for growth- Temperature, pH and other factors. Growth curve of bacteria -continuous culture and syschrous culture. Microbial genetics - genetic elements in microorganism. Bacteriophages - lytic & lysogenic types - conjugation, transformation, transudation and mutation in bacteria. Principles of imunology. Industrially important microorganisms & their products microorganisms in various forest ecosystems - Isolation and enrichment methods Facters affecting microbial population in soil. Microbial decomposition of organic matter - organisms involed - carbon cycle - microbiology of compositing methane and methanogensis. 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 afforestatsion of waste land. Tree rhizosphere and its importance - interrelationships between soil microoranisms - Associative antagonistic & symbiotic. 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 .

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. Inentification 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 Azospirilhum and phoshobacteria - 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 - spotaneous 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 Microbilogy - scope and signification of Forest Microbilogy - Microbiology - resolving power- numerical aperture, magnification - different types of microbiology and micrometry.
- Structure and organization of microbil cell : Prokaryotes and Eucaryotes, Various groups of microorganisms - bacteria , Fungi actinomycetes, lgae, protozoa and virous. Methods of isolation and purification.
- Types of nutrional media - sterilisation - principes of staining microirganisms. Preservation of microbial cultures.
- Nutritional types: autoroph, heterotroph, phototroph and chemolithotrophs.
- Requirements for growth- Temperature, pH and other factors. Growth curve of bacteria - continuous culture and syschrous culture.
- Microbial genetics - genetic elements in microorganism. Bacteriophages - lytic & lysogenic types - conjugation, transformation, transudation and mutation in bacteria.
- Principles of imunology. 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 involed - carbon cycle - microbiology of compositing methane and methanogensis.
- 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 afforestatsion of waste land.
- Tree rhizosphere and its importance - interrelationships between soil microoranisms - Associative antagonistic & symbiotic.
- 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.

Practical

Content

- 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 Azospirilhum and phoshobacteria -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.

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COURSE CODE: AGFO-411

COURSE TITTLE: INTRODUCTION TO MEDICINAL AND AROMATIC PLANTS

CREADIT HOURS Cr. 3(2+1)

Theory

Role of medicinal and aromatic plants in national economy, history, scope, opportunities and constraints in the cultivation, utilisation and processing of medicinal and aromatic plants in India. Efficiencies of crops at different tiers, rainfall, humidity, temperature, light and soil pH on crop growth and productivity, high density planting, nutritional requirements, physiological disorders, role of growth regulators and macro and micro nutrients, water requirements, fertigation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices,importance, origin, distribution, area, production, climatic and soil equirements, propagation and nursery techniques, planting and aftercare, training and pruning, nutritional, Active principle, physiochemical properties and water requirements. Plant protection, harvesting, processing and economics of under mentioned important medicinal and aromatic plants. Medicinal Plants: Black pepper, cardamom, clove, ginger, turmeric, Agar wood, Cedar wood, 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 important medicinal and aromatic plants, their processing, 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

- Role of medicinal and aromatic plants in national economy, history, scope, opportunities and constraints in the cultivation and utilisation of medicinal and aromatic plants in India. 2
- Efficiencies of crops at different tiers, rainfall, humidity, temperature, light and soil pH on crop growth and productivity, high density planting, nutritional requirements, physiological disorders. 2
- Role of growth regulators and macro and micro nutrients, water requirements, fertigation, moisture conservation, shade regulation, weed management, training and pruning, crop regulation, maturity indices 2
- Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and aftercare, training and pruning, nutritional and water requirements. 3

- Plant protection, harvesting, processing and economics of under mentioned important medicinal and aromatic plants. 2
- Medicinal Plants: pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, *Rauvolfia*, *Dioscorea*, isabgol, *Ammi majus*, *belladonna*, *Cinchona*, *pyrethrum* and other species relevant to local conditions. 5
- 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. 4
- 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. 3
- Therapeutic and pharmaceutical uses of important species. 1

Practical

Content Lecture

- Morphological description and identification of various medicinal plants. 2Collection 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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STFB-414 **WOOD ANATOMY** **Credit- 3(2+1)**

Theory

Introduction, importance & scope of Wood Anatomy. The plant body – Cell and organelles, Meristematic Tissue & their Function- promeristem, primary meristem, secondary meristem, apical and intercalary meristems. Simple tissues and their function- 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. Wood structure in relation to wood properties. Formation of early and late wood and their properties , 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 & diagnostic features 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, importance & scope of Wood Anatomy.	2
• The plant body – Cell and organelles,	2
. Meristems, promeristem, primary meristem,	2
secondary meristem, apical and intercalary meristems.	2
•Simple tissues and their function parenchyma,collenchyma,sclerenchyma.	2
• Complex and vascular tissues. Anatomy of stems and roots of dicots and monocots.	3
• The secondary growth in woody plants.	2
• Mechanism of wood formation.	2
.Wood structure in relation to wood properties.	2
• Formation of early and late wood, growth rings, transformation of sapwood to heartwood.	3
• 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.	2

• Disruption of continuity of inner wood, shakes, included bark, resin pockets, pith flecks, knots (live and dead).	2

Practical

Content	**Lecture**
• Hand lens features of soft wood and hardwood, sapwood and heartwood specimens	1
. 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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STFB-415APPLIED FOREST MENSURATION 3(2+1)

Theory: 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.

Theory

Content	Lecture
• Taper and classification of form factors and form quotient.	2
• Volume estimation of felled and standing trees and formulae involved.	3
• Volume tables-definition and their classification,	2
• (general, regional and local volume tables),	3
• merchantable volume tables. Preparation of volume tables.	3
• Stand growth, site quality, site index, stand structure,	2
• yield tables and preparation of yield tables.	2
• Biomass measurement. Determination of age of trees.	3
• Tree growth measurements,	2

- objectives increment, determination of increment, 2
- stump analysis, stem analysis and increment boring. 3
- Measuring tree crops - objectives, diameter, diameter and girth classes, 3
- Height measurement of crop, crop age and crop volume. Stand tables. 3
- Forest inventory-definition, objectives, kinds of enumeration. 3
- Sampling - definition, advantages, kinds of sampling, 3
- Random sampling: (simple, stratified, multistage and multiphase sampling). 2
- Non random sampling (selective, systematic and sequential sampling) sampling design, 2
- Size and shape of the sampling units. 2
- Point sampling - horizontal and vertical point sampling. 2
- Introduction to remote sensing and its application in forestry.2

Practical

Content	**Lecture**
Measurement of bark thickness,	1
Measurement volume, bark area and crown parameters.	2
Volume estimation of logs,	1
felled trees and standing trees.	2
Preparation of volume tables,	1
volume estimation of forest stands.	1
Stump analysis and increment boring.	2
Determination of age of standing trees.	1
Calculation of CAI and MAI.	2
Sampling exercises including Point sampling.	2
Calculation of crop diameter, crop height and crop volume.	2
Estimation of form factor.	1
Estimation of canopy density.	1
Use of aerial photographs in forest inventory.	1
Study of different satellite images and their application in forestry.	1

- **References**

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SEMESTER - IV

ENVS-421 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 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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COURSE CODE: AGFO-421

COURSE TITTLE: INTRODUCTION TO AGROFORESTRY

CREADIT HOURS Cr. 3(2+1)

Theory

Indian agriculture its structure and constrants. Land use definition, classification and Planning. Agroforestry - definition, aims, objectives, need and scope. Classification of agroforestry system - structural, functional, socio-economic and ecological basis. Traditional agroforestry systems: Taungya system,Shifting cultivation, wind break, shelterbelts, Homestead gardens'. Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations.. Multipurpose tree species and their characteristics. Tree architecture, canopy management - lopping, prunning, pollarding and hedging. Diagnosis and design. Agroforestry systems in different agroclimatic zones, components, production and management techniques. Nutrient cycling, soil conservation, water shed 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 constrants. 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, socioeconomic and ecological basis. 1
- Multipurpose tree species and their characteristics. 1
- Tree architecture, canopy management - lopping, prunning, 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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STFB-421 SILVICULTURE OF INDIAN TREES Cr. 3(2+1)

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, Albizzia spp, Prosopis spp. Pterocarpus santalinus, Azardirachta 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 sisoo 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: *Abies pindrow, Picea smithiana, Cedrus deodara, Pinus roxburghii,*	3
• Silvicultural systems and economic importance of the following conifer *Pinus wallichiana, P. gerardiana and Juniperus macropoda*.	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Tectona grandis, Shorea robusta, Acacia spp.,*	4
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Dalbergia sissoo, D latifolia, Quercus spp.*	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Robinia pseudoacacia, Alnus spp. Anogeissus spp.*	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Populus spp, Eucalyptus spp. Casuarina equisetifolia,*	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Terminalia spp., Santalum album, Swietenia mahagony,*	4
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Albizzia spp, Prosopis spp. Pterocarpus santalinus,*	3
• Silvicultural systems and economic importance of the following broadleaved tree species of India. *Azardirachta 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, *Dalbergia sisoo* and *Acacia catechu*, 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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STFB-422 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 - scocio - cultural characteristics - traditional beliefs - values - norms - customs - taboos -changing trends in life style - social struture - 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 lows -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 - scocio - cultural characteristics - traditional beliefs - values - norms - customs - taboos - changing trends in life style - social struture - emergence of leadership -social movementsadministration 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
•Formal inventorying and bird/ animal watching.	3

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STFB-423 WOOD SCIENCE & TECHNOLOGY Cr. 3(2+1)

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 contact. 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 contact.	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, murrammy 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, murrammy 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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STFB-424 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 micro propagation. 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 bare root 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 – 540 **Agricultural Statistics** **3(2+1)**

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

Practical: Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped and Grouped data; Computation of Mode for Un-Grouped and Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; SND test for Means, Single Sample; SND test for Means, Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r' and its testing; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

Lecture:

- Introduction: Definition of Statistics and its use and limitations-1
- Frequency Distribution and Frequency Curves; Measures of Central Tendency-1
- Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean-2
- Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation-2
- Probability: Definition and concept of probability-1

- Normal Distribution and its properties; Introduction to Sampling: Random Sampling-2
- the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis-2
- Large Sample Test- SND test for Means, Single Sample and Two Samples (all types)-2
- Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test-2
- F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity-2
- Correlation: Types of Correlation and identification through Scatter Diagram-2
- Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y-2
- . Inter-relation between 'r' and the regression coefficients, fitting of regression equations-1
- . Experimental Designs: Basic Designs, Completely Randomized Design (CRD)-2
- Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD)-2
- Layout and analysis, Latin Square Design (LSD), Layout and analysis.2

References

1. Bernard Ostle and R.W.Mensing, Statistics in Research.
2. C.H. Goulden, Method of Statistical Analysis.
3. G.W. Snedecor and W.G. Cochran, Statistical Methods.
4. R.G. Steel and J.H. Torrie, Principles and Procedures of Statistics (with special reference to Biological Sciences)
5. R.Rangaswamy, A Text Book of Agricultural Statistics.
6. V.G.Panse and P.V.Sukhatme, Statistical Methods for Agricultural Workers.
7. W.T. Federer, Experimental Design (Theory and Application).
8. W.G. Cochran and G.M.Cox, Experimental Designs.
9. V.G. Panse and P.V. Sukhatme, Statistical Methods for Agricultural workers.
10. R.S.D. Steel and J.H. Torrie, Principles and procedures of Statistics (with special reference to Biological Sciences).
11. C.H. Goulden, Methods of Statistical Analysis.
12. Ram Singh Chandel, A Handbook of Agricultural Statistics.
13. G.W. Snedecor and W.G. Cochran, Statistical Methods.
14. M.N. Das and N.C. Giri, Design and Analysis of Experiments.
15. K.A. Gomez and A.A. Gomez, Statistical Procedures for Agricultural Research.
16. R.Rangaswamy, A Text Book of Agricultural Statistics.

B.Sc. FORESTRY Semester -IVTh

AEAB-410 FOREST MARKETING AND FINANCIAL MANAGEMENT Credit 3(2+1)

Role of marketing in open market economy. Marketing functions, market behavior segmentation, competition, regulation, cases studies of forest products, capital and credit management. Principle of credit and its classification. Balance sheet and its role in financial management. Project: Concept, components, preparation and analysis. Cost and benefit streams. Financial and economic aspect of Project analysis. Determining financial and economic values. Investment analysis at farm/forest and industry levels. Adjusting financial prices to economic values, trade policy signals form project analysis, valuing intangible costs and benefits. Discounted cash flow analysis, time value of money, compounding, discounting, present value, timing of cash flows, discount rate, criteria for investment appraisal, present value and its acceptance rule, internal for return and its acceptance rule, break even price (or stumpage), assessment of present value and internal rate of return rules. Implementation control and evaluation of projects. Designing procurement systems and introducing sustainable development into the planning and implementation of forestry development projects.

Theory

Content Lecture

Role of marketing in open market economy - 2

Marketing functions: market behavior segmentation, competition, regulation, cases studies of forest products, capital and credit management -3

Principle of credit and its classification: Balance sheet and its role in financial management -2

Project: Concept: components, preparation and analysis. Cost and benefit streams-3

Cost and benefit streams: Financial and economic aspect of Project analysis. Determining financial and economic values. Investment analysis at farm/forest and industry levels-3

Adjusting financial prices to economic values, trade policy signals form project analysis, valuing intangible costs and benefits: -3

Discounted cash flow analysis: , time value of money, compounding, discounting, present value, timing of cash flows, discount rate, criteria for investment appraisal- 3

Present value and its acceptance rule, internal for return and its acceptance rule, break even price (or stumpage) -3

Assessment of present value and internal rate of return rules: 2

Implementation control and evaluation of projects -2

Break even price (or stumpage), - 1

Assessment of present value and internal rate of return rules- 2

Designing procurement systems - 2

Introducing sustainable development into the planning -2

Implementation of forestry development projects.-2

Reference

1. S. S. Acharya, Agricultural Marketing in India, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1992..
2. Ramchandra and Dr. Rahul Agrawal, Principles of Forest Economics: International Book Distributors, New Delhi, Ruby Publication New Delhi, 2013.
3. Ramchandra and Dr. Rahul Agrawal Gadhian Political Economy International Book Distributors, New Delhi, Maxford Publication New Delhi, -2013.

SEMESTER - V

AGFO-511 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.
3. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
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.

STFB-511 WILDLIFE MANAGEMENT & BIOSPHERE Cr. 3(2+1)

Theory

History of wildlife management and conservation in India; cultural background. Habitat management: Purposes, principles, practices and tools-fire, cutting, grazing. Habitat interspersion 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. Zoo Policy of India. Wildlife census : Purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities. 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 interspersion 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
- Zoo Policy of India 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

References

1. Robert, G.H. 1978. Wildlife management. W.H. Freeman and Co., San Francisco, U.S.A.
2. Anon, 1990. Collection and preservation of animals. Zoological Survey of

India.
3. Grzimek, 1988. Encyclopedia of mammals. McGraw Hill Publishing House, New Delhi.
4. Katwal/Banerjee. 2002. Biodiversity conservation in managed and protected areas. Agrobios, India.
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6. Otto H. Frankal, A. Anthony, D. Brown and Jeremy J. Burdon. 1995. The conservation of plant biodiversity. Cambridge University Press.
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8. Sale, J.B. and K. Berkmuller. 1988. Manual of wildlife techniques for India. WII, FAO, Dehra Dun, India.
9. Sharma, B.D. 1999. Indian wildlife resources: Ecology and development. Daya Publishing House, Delhi.
10. Singh, S.K. (2005) Text Book of Wildlife Management .International Book Distributing Co., Dehradun.

STFB-512 TREE IMPROVEMENT Cr. 3(2+1)

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 & phonological 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

References

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2. FAO. 1985. Forest Tree Improvement, FAO Publication, Rome, Italy. 270p.
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7. Mandal, A.K. and Gibson, G.L.(eds)1997. Forest Genetics and Tree Breeding. CBS Publi. & Distr., New Delhi 268p.
8. Wright, J.W. 1976. Introduction to Forest Genetics. Academic Press, New York. 463p.
9. Zobel, B.J. Wyh, G.V. and Stahl, P. 1987. Growing Exotic Foreste. John Wiley &

Sons, New York. 508p.

STFB-513 WOOD SEASONING AND PRESERVATION Cr. 3(2+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. Recommended moisture content of seasoned timber for different end uses in different climatic zones, and permissible tolerances. Basis of the recommendations. Seasoning of timber – kinds of seasoning – Air seasoning methods, Factors controlling air seasoning – Kiln seasoning – factors controlling kiln seasoning – various timber drying sheds – classification of timber due to seasoning – seasoning defects –Surface and internal cracking, honey combing, end splitting, cupping, collapse, bow, spring, crookedness, causes and their prevention. 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 & their characteristics - kinds of preservative, methods of 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.General outline of kiln drying schedules. Visit to wood depot for studying defects- preparation and use of different preservation. Boucherie, sap displacement. Hot and cold bath and diffusion treatment. 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	1
• Effect of seasoning and preservation of timber on the economy of timber.	2
• Principles and methods of seasoning.	2
• Influence of temperature – relative humidity and air circulation.	2
• Mechanism of wood seasoning.	1
• Fibre saturation point and its signification.	1
• Determination of moisture content.	2
• Recommended moisture content of seasoned timber for different end uses in different climatic zones, and permissible tolerances.	2
• Basis of the recommendations.	2
• Seasoning of timber – kinds of seasoning – Air seasoning methods.	2
• Factors controlling air seasoning – Kiln seasoning – factors controlling kiln seasoning .	2
• Various Timbers drying sheds.	1
• Classification of timber due to seasoning – seasoning defects.	2
• Surface and internal cracking, honey combing, end splitting, cupping, collapse,	

bow, spring, crookedness, causes and prevention. 2

- Seasoning behaviour for few trees like Teak, Sal, Silver oak, bamboo, Dalbergia. 2
- Preservation of timber – Introduction, Importance & scope 1
- Agencies causing timber deterioration – Decay – Insect – Termites 2
- Durability of timbers – classification of timber in the order of durability. 1
- Mechanism of wood preservation preparation . 1
- Preparation of wood for preservative treatments. 1
- Treatability and Durability of timber. 2
- Wood preservation – selection of preservatives. 2
- Kinds of preservative & methods preservation – application processes. 1
- Pressure and non – pressure process. Fire protection of timbers. 2

Practical

Content	**Lecture**
• Identification of casual agencies of destroying timber	1
• Estimation of defects due to seasoning.	2
• Measurement of moisture content of wood.	2
• Study of various seasoning kilns and drying sheds.	1
• General outline of kiln drying schedules.	1
• Visit to wood depot for studying defects-	3
• Preparation and use of different preservation.	2
• Boucherie, sap displacement.	2
• Hot and cold bath and diffusion treatment.	1
• Laboratory methods for assessing the effect of preservation study of the preservation	1
• Application for fresh and dry timber.	1
• Preservation application for few timber species like Teak, Sal. *Terminalia,Dalbergia.*	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. .
3. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
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.
6. Negi, S. S. Handbook of Wood science & Technology, IBD, Dehradun

STFB-514 TREE PHYSIOLOGY Cr. 3(2+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, Transpiration: Stomatal movement and Antitranspirant, Mineral Nutrition, Movement and Rhythms in Trees, 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.Physiology of Flowering, 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 and its impact on plant water relations and photosynthesis.	1
• 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
• Transpiration: Stomatal movement and Antitranspirant	1
• Mineral Nutrition	1
• Physiology of Flowering	1

Movement and Rhythms in Trees

STFB-515 FOREST PATHOLOGY & DISEASE MANAGEMENT Cr. 3(2+1)

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 Aphyllophoraeae 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 Aphyllophoraeae 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, *Dalbergia sp., Acacia spp., neem, cassia, sal, Albizia, Terminalia,* mango, jack, pines, *deodar, eucalyptus,* bamboo, *casuarina,* 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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AGFO-512 COMMERCIAL FORESTRY Cr. 2(1+1)

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 relbating 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 plants, 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, hauched - stop stenon - force face tenon, bridle jointss. Dovetail joints - types. Different types of broadening joints - simple butt, related butt, pocket, pocket crew, gluded 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 relbating 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 plants, 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, hauched -stop stenon - force face tenon, bridle joints.	2
• Dovetail joints - types. Different types of broadening joints - simple butt, related butt, pocket, pocket crew, gluded 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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STFB-516 LOGGING & ERGONOMICS Cr. 3(2+1)

Theory:

History of development of timber extraction .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. Seasons for felling. Conversion of timber at out side the forest, measurement and description of converted material, log-making. Factors that determine the log length .Systems of extraction and disposal of timber, Size of material in logging operation. 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. Timber Depots- types, lay out and management. Ergonomics: definition, components and provision of energy. Requirement of energy and rest periods. Forest labour, Labour organization and Labour Camp.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

- History of development of timber extraction. 1
- Definition and scope of logging, logging plan and execution. 2
- Location and demarcation of the area for logging and estimation of produce Available for extraction. 2
- Implements used in logging operation- traditional and improved tools. 2
- Seasons for felling ,Felling rules and methods. 1
- log-making. Factors that determine the log length 2
- Conversion, measurement and description of converted material. 1
- Means of transport of timber- carts, dragging, skidding, overhead transport, ropeways, skylines. 2
- Transport by road and railways. Transport by water- floating, rafting and concept of booms. 2
- 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. 2
- 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. 2
- Accidents: causes, statistics, safety rules and first aids. 1
- Plants, animals and insect infestations; diseases and their prevention. 2
- Forest labour, Labour organization and Labour Camp. 2

Practical

Content

- 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 relevantregisters; 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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AGRN-513 INTRODUCTION TO MAJOR FIELD CROPS Cr. 3(2+1)

Theory

Classification and distribution of field crops, definition and concept of multiple cropping, mixed cropping, intercropping, relay and alley cropping, cultural practices for raising major cereals: Rice, Wheat, Maize, Oats Rye, Sorghum. Pulse Crop: Chickpea.Pigeon pea.Green gram, Black gram. Oil Seeds: Groundnut, Mustard, Soyabean, Sunflower, Castor, Linseed. Fibre Crops: Cotton, Jute, Hemp, Linseed. Fodder Crops: Sudan grass, Guinia Grass, Napier Grass, Rhodus Grass, Cowpea, Stylo, Alfaalfa

Practical

Identification of crop plants, seeds and weeds. Preparation of cropping scheme. Application of herbicides in field crops.

Theory Content Lecture

- Classification and distribution of field crops definition and concept of multiple cropping-2
- Mixed cropping, intercropping, relay and alley cropping cultural practices for raising major cereals: Rice, Wheat, Maize, Oats Rye, Sorghum. 5
- Pulse Crop: Chickpea. Pigeon pea. Green gram, Black gram.3
- Oil Seeds: Groundnut, Mustard, Soyabean, Sunflower, Castor, Linseed.4

- Fibre Crops: Cotton, Jute, Hemp, Linseed-4
- Fodder Crops: Sudan grass, Guinia Grass, Napier Grass, Rhodus Grass, Cowpea, Stylo, Alfaalfa-4

SEMESTER – VI

AGFO-521FOREST 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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STFB-521 FOREST POLICY AND LEGISLATION: Cr. 3(3+0)

Theory:

Forestry administration and organization. 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 –Factors affecting forest policies 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. Rights and consseions in Forests - Indian Forest Act of 1927 – Forest Conservation Act of 1980 – its amendment in 1988 .wildlife protection Act of 1972 and its amendment in 1991 and 2002. – Uttar Pradesh Forest Corporation Acts and Uttar Pradesh Forest policy. International Timber Trade Agreement _ GATT Agreements its relevance to timber exports- Rio submit its relevance to timber trade. History of Joint Forest Management-Concept and objective of JFM. Tribal Act 2006.

Theory

Content

Lecture

- Forestry administration and organization 2
- Forest Policy: definition, necessity and scope. 2
- Legal and institutional approaches to forest resource management. 2
- Objectives of forest policy- necessity and scope- range and various considerations – 2 foundation of stable forest policy. 2
- History of Forest Policy in India - Forest policy of 1894. 2
- The need for revision – National Forest Policy of 1952. 3
- Recommendations of National Commission on Agriculture 1976. 1
- National Forest Policy 1988. 3

- Rights and consseions in Forests 2
- Forest protection and law- study of law in relation to forest education 2
- Necessity of forest law – the concepts of rights 2
- Obligations and privileges –their relevance to forestry. 2
- Indian Forest Act of 1927. 4
- Forest Conservation Act of 1980 – its amendment in 1988. 3
- Wildlife protection Act of 1972.and its amendment in 1991 and 2002 3
- Uttar Pradesh Forest Acts – International Timber Trade Agreement. 3
- GATT Agreements its relevance to timber exports. 3
- Rio submits its relevance to timber trade. 2
- History of Joint Forest Management. 2
- Concept and objective of JFM. 2
- Tribal Act 2006. 2

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STFB-522 PLANTATION FORESTRY Cr. 3(2+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.
- Exercise on plantation layout.
- Collection of data for survival and growth performance.
- Use of fertilizers, weedicides for plantation management.

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STFB-523 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. Totipopentcy of cells. Embryogenesis, organogenesis and asomaclones. Shoot tip culture and clonal propagation. Meristem culture and disease elimination. Anther, pollen and miscrospore culture, ovary and embryo culture, haploid, somatic hybrids - cybrids - transformed plants. Tissue culture for tree improvement. Microprogation. 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
• Micro propagation-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
• Totipopentcy of cells.	1
• Embryogenesis, organogenesis and asomaclones.	2
• Shoot tip culture and clonal propagation.	1
• Meristem culture and disease elimination.	1

- Anther, pollen and miscrospore culture, ovary and embryo culture, haploid, somatic hybrids 3
- cybrids - transformed plants. 1
- Tissue culture for tree improvement. 1
- Microprogation. 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 transferees - 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 palnts.	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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AEAB-510 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 -Low of diminishing marginal return - impact of technological changes in production.Cost concept - cost function - cost curves - factor relationship - isoquonts - 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. Markets and market structure, Marketing of forest products 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 cultiation of trees – break even analysis and budgeting. Studying government, co-operative and private agencies involved in marking 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 - isoquonts - 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 principle	3
• 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, Markets and market structure, Marketing of forest products market structure and conduct of important timber and non-timber markets. 3
- 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 cultiation of trees - break even analysis and budgeting.	1
• Studying government, co-operative and private agencies involved in marking 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

References

1. Edwin S. Mills, Economic Analysis of Environmental Problems (New York: Columbia University Press), 1975.
2. Fisher, A.C., Resource and Environmental Economics (New York: John Wiley & Sons), 1979.
3. Orris C. Herfindahl, Natural Resource Information for Economic Development (Baltimore: The Johns Hopkins University Press), 1969.
4. Sharma, S.D., A New Approach to Linear Programming (Meerut: Kedarnath, Ramnath and Co.), 1975.
5. Tony Prato, Natural Resource and Environmental Economics (Ames: Iowa State University Press), 1998.

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 damps - 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 damps - 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

References

1. Datta, S.K. 1986. Soil Conservation and Land Management, International Book Distributors, Dehra Dun.
2. Hamilton, I.S. 1987. Forest and Watershed Development and Conservation in Asia and the Pacific, International Book Distributors, Dehra Dun.
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6. Rajesh Rajora, 1998. Integrated watershed Management, Ravat Publication, New Delhi.
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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 growing zones.	3
• 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

References

1. Chadha, K.L. 2001. Hand Book of Horticulture. ICAR Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi.
2. Farooqi, A.A. and B.S. Sreeramu. 2001. Cultivation of Medicinal and Aromatic Crops. Universities Press (India) Ltd. 3-5-819, Hyderguda, Hyderabad - 29.
3. Kumar, N., J.B. Md. Abdul Khadar, P. Rangaswamy and I. Irulappan. 1982. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Planters Chronicle. Monthly Publication. UPASI, Coonoor.
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AGFO-522 RANGELAND MANAGEMENT Cr. 3(2+1)

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	2

management, animal.

- 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 and principles 2
- 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

1. Vijendra Das,L.D.(1998). Forage Crops. International Book Distributors, Dehradun.
2. Simmonds, W.W. 1986. A short review of farming systems research in the tropics. Expl. Agric. 22:1-13.
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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.

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Course: Agricultural Disaster Management

Course Code: ENVS-521 **Credits: 2(2+0+0)**

1. **Basic concepts of disaster:** Definition, Introduction to natural and manmade disasters. History of natural disasters in India, Concept of risk, hazard, and vulnerability.
2. **Natural Disaster:**
    a) **Floods and Flash floods:** general characteristics, causes, nature and frequency of flooding floodplains, flood hydrographs, river and coastal floods.
    b) **Droughts**; causes,classification - agricultural, hydrological and meteorological droughts; drought frequency and intency.
    c) **Cyclones and Tsunamis;** structure and nature of cyclones and tsunamis, characteristics factors, hazard potential
    d) **Landslides**, causes, susceptibility to landslides and slope failures.
3. **Disaster Impact Assessment:** severity, extent of damage on agricultural production systems, economic losses affecting livelihood, social and economic perspective.
    a) **Crop loss;** quantity, quality, social and economic perspective.
    b) **Livestock/Fish/Poultry**: mortality, morbidity, health, reproduction, yield, feed and fodder availability.
    c) **Irrigation Infrastructure**: siltation, damage to canal network, tube wells, open wells, dug wells, channels, ponds etc.
    d) **Soil and Water**: Impact on soil erosion, water availability, accessibility and quality.
4. **Planning and Preparedness for Disaster Management:** strategies for disaster management planning, role of IT, remote sensing, GIS and GPS in disaster preparedness,
5. **Frameworks, Approaches and Methods for Disaster Risk Reduction:** understanding resilience, disaster response and post disaster recovery, nature and type of immediate response, disaster management plans,
6. **Contingency Planning for Disaster Risk Reduction:** agronomic, engineering other non-engineering interventions for drought, flood, agro-met advisories, crop advisories, community nursery, contingent seed bank, mini-kit availability, strategies for fisheries management in

flood prone areas, livestock shelters, feed and fodder banks, mass vaccination of livestock, etc.

7. **Policies for Disaster Management:** Disaster Management act and Policies in India, Insurance and loan schemes: criteria and constraints of crop/animals insurance and credit guarantee schemes.

8. **Case studies and field visits.**

COURSE CODE: AGFO-523

COURSE TITTLE: SOCIAL FORESTRY AND JOINT FOREST MANAGEMENT

CREADIT HOURS Cr. 2(2+0)

Theory

Concept and definition of agroforestry, social forestry, community forestry and farm forestry; Benefits and constraints of agroforestry; Historical development of agroforestry and overview of global agroforestry systems.Social/Urban Forestry : scope and necessity; peoples participation.National forest policies: strategy and objectives of social forestry. Fuel, fodder and timber crisis in developing countries JFM - principles, objectives, methodology, scope, benefits and role of NGOs.Contributory Factors for the Success of Joint Forest Management. Human Resource Development-concept as applicable to forestry programs, Social and human relationship models.

Theory

	Content	Lecture
•	Concept and definition of agroforestry, social forestry, community forestry and farm forestry	2
•	Benefits and constraints of agroforestry	2
•	Historical development of agroforestry and overview of global agroforestry systems.	2
•	Choice of species and management of social forestry plantations	2
•	Social/Urban Forestry : scope and necessity; peoples participation.	3
•	National forest policies: strategy and objectives of social forestry	2
•	Fuel, fodder and timber crisis in developing countries	2
•	JFM - principles, objectives, methodology, scope, benefits and role of NGOs.	1
•	Contributory Factors for the Success of Joint Forest Management.	2
•	Human Resource Development-concept as applicable to forestry programs, Social and human relationship models.	1

References

1. F.A.O. 1978. Forestry for local community development. FAO Publication, Rome, Italy.

2. Negi,S.S.1986. A Hand book of Social forestry. 1986, International Book Distributors, Dehradun.
3. Prasad, V.N. 1985. Principle and practice of social-cum-community forestry. International Book Distributor, Dehradun.
4. Shah, S.A. 1988. Forestry for people. ICAR Publication, New Delhi.
5. Sharma,B.L and R.L. Vishinoi.2000. Perspective on Social forestry .Daya Publishing House.
6. Singh, B. 1992. Social forestry for rural development. Animol publication.
7. Singh, M.P., Chinnamalai, S. and Trivedi, R.N. 1993. Social forestry and environment. International Suggested Readings and Periodicals, Delhi.

SEMESTER – VII

(Experimental Learning/Hands on Training)

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

Course Code	Title	Credits
STFB-611	Production and Marketing of Quality Planting Material	20 (0+20)
STFB-612	Cultivation and Processing of Medicinal Plants	20 (0+20)
ENVS-610	Natural Resource Management	20 (0+20)
	Total Credits	**20 (0+60)**

Multidisciplinary Courses:
ISTFB-611**.Production and Marketing of Quality Planting Material**

Activity	Weeks	Credit
• **Project Development** Identification of species (grasses, trees, medicinal plants & wild fruits) for nursery raising, time of collection of plant material from selected seed sources, quantity of seed/plant material required, nursery area (open and protected), inputs required, Schedule for intercultural operation- seed treatment, sowing, weeding, fertigation, root hardening treatments. Assessment of demand in local/potential markets and institutions; Physical Needs: i. Number of tree species – 3-5 ii. Minimum planting stock production – 5000seedlings/species iii. Grasses - 0.25ha land area iv. Protected area – 50-100 sq m	3	2(0+2)
•Collection, Handling, Processing and Storage of planting material: Identification of superior seed sources, seed collection, treatment and storage	3	2(0+2)
• Vegetative Propagation under controlled and ambient conditions Collection of vegetative propagules, treatment and its processing of bare root and containerised seedlings	3	3(0+3)

• Nursery Management Raising, seed bed preparation, raising of polyhouse, sowing, planting and other inter-cultural operations	11	9(0+9)
• Marketing of seeds and seedlings; grading of quality stock and pricing	2	2(0+2)
• Cost Benefit analysis, Project Report & Presentation	1	2(0+2)
Total	**23**	**20(0+20)**

I. STFB-612**Cultivation and Processing of Medicinal Plants**

Activity	Weeks	Credit
Market Survey & Prioritization of species: Visit to marketing centers in the region, assessment of demand and trade in specific species suitable for cultivation in the respective regions; exploring possibilities of buy back and linkages with industries.	2	2(0+2)
Project proposal development: Defining objectives, cultivation and processing methodology to be adopted, advisement needed, necessary support required and expected outcome.	1	1(0+2)
Raising of selected crop/s (at least two crops in 500 sq m for each crop): The activities includes all necessary cultural practices for nursery raising, transplantation, hoeing, weeding, irrigation, fertigation, plant protection measures etc.	14	9(0+9)
Harvesting and post-harvest management: The activities include harvesting at optimum stage, drying, garbling, grading, packing and storage.	2	2(0+2)
Primary processing and value addition: The activity involves exposure of the student to basic chemical extraction processes, distillation of essential oils, preparation of powders, tinctures, extractives etc.	3	2(0+2)
Marketing of produce, project report and presentation.	2	2(0+2)
Total	**23**	**20(0+20)**

III.ENVS-610 Natural Resource Management:

Activity	Weeks	Credit
1. Resource Survey and Evaluation Operational area and land use - 100-250 ha micro watershed Soil, Water, Vegetation, Livestock Resources Soil Erosion – types and extent, land degradation Wastelands – types and extent Climatic parameters Socio-economic parameters- constraints, need and potentials	3	4(0+4)
2**. Preparation of Resource Maps using GIS and Remote Sensing** :GIS and Remote Sensing applications Feeding of data collected from survey and preparation of maps, inventories and reports Attachment: State/University, GIS and Remote Sensing Centres (GIS and Remote Sensing facilities to be developed at SAUs, if not available).	8	5(0+5)
3. Preparation of Micro-Plans for efficient use of natural Resources: Soil, Water, Vegetation and others. (The Plan will be prepared on integrated micro-watershed basis for the development and their efficient utilization)	3	3(0+3)
4. Resource Conservation and Production Technologies: Resource Conservation • Operational area • micro-watershed including arable, non-arable and waste lands conservation • Vegetative measures: Grasses, Shrubs and Trees and their combinations • Structural designs including principles and practices: erosion control measures such as check dams, spurs, Gabion structures. • Water conservation: ground water recharging, in-situ water conservation and vegetative and mechanical barriers. • Land shaping, trenching, bunding and terracing and mulching. • Percolation Structures **Production** • Agroforestry and Avenue plantations including wind breaks, shelterbelts etc.) • Agronomical practices: land use (horticulture, forestry, agriculture)	4	3(0+3)
5.Case Studies Environment Impact Assessment (EIA) and Strategic Environment Appraisal (SEA) in specific problematic sites	4	3(0+3)

or Disaster Management: Forest fire, floods/ droughts/ landslides and slips/avalanches/storms/tsunami. or Watershed Management		
6. Project Report & Presentation	1	2(0+2)

SEMESTER - VIII

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

S.No.	Course Code	Subject	Credit
1	STFB-621	Forest Project/ Industrial Placement/ Institutional Attachment	15(0+15)
2	STFB-622	Study Tour	8 (0+8)
3	AGFO-621	Forest Work Experience	6 (0+6)
Total credits			**29 (0+29)**

STFB-621FOREST PROJECT / INDUSTRIAL PLACEMENT /NSTITUTIONAL ATTACHMENT Cr. 15(0+15)

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 progrmme 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 Breding
- Transfer of Technology

STFB-622 **STUDY TOUR Cr. 8(0+8)**

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

AGFO-621 FOREST WORK EXPERIENCE Cr. 6(0+6)

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 illcit 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. conservation measures - tackling illcit 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	100.00