

TELANGANA UNIVERSITY, NIZAMABAD –TELANGANA
FACULTY OF SCIENCE
CBCS COMMON CORE SCHEME FOR B.Sc. COURSE (2021-2022 ONWARDS)
OPTIONAL: FORESTRY

CODE	PAPER TITLE	Course Type	HPW	Credits
FIRST YEAR - Semester - I				
FOR 104	DSC-1A: Forests and Forestry	DSC-1A	4T + 2P = 6	4+1=5
FIRST YEAR - Semester - II				
FOR 204	DSC-1B: Silviculture	DSC-1B	4T + 2P = 6	4+1=5
SECOND YEAR - Semester - III				
FOR 304	DSC-1C: Wildlife biology	DSC-1C	4T + 2P = 6	4+1=5
FOR 301	SEC - 1: Plantation Forestry	SEC - 1	2	2
FOR 302	SEC - 2: Marketing and Certification of Forest Products	SEC - 2	2	2
SECOND YEAR - Semester - IV				
FOR 404	Paper IV: Forest Mensuration & Management	DSC-1D	4T + 2P = 6	4+1=5
FOR 401	SEC - 3: Eco-Tourism	SEC - 3	2	2
FOR 402	SEC - 4: Urban Forestry	SEC - 4	2	2
THIRD YEAR - Semester - V				
FOR 502	DSE -1A: Forest Utilization DSE - 1B: Forest Economics and Business Management DSE - 1C: Watershed Management	DSE - 1A/ DSE - 1B/ DSE - 1C	4T + 2P = 6	4+1=5
FOR 501	GE - 1: Forest Ecology & Dendrology	GE - 1	4T	4
THIRD YEAR - Semester - VI				
FOR 601	DSE - 2A: Forest Protection DSE - 2B: Forest Legislation DSE - 2C: Forest Soils & its Conservation	DSE - 2A / DSE - 2B/ DSE - 2C	4T + 2P = 6	4+1=5
FOR 602	DSE-3: Project	PROJECT	4	4

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FIRST YEAR - Semester - I	
PAPER I	Fundamentals of Silviculture, Factors effecting forestry, Silviculture of Trees, Agro, Social and Urban Forestry
FIRST YEAR - Semester - II	
PAPER II	Forest Ecology, Biodiversity and Environmental conservation, Forest Mensuration
SECOND YEAR - Semester - III	
PAPER III	Advance Silviculture, Propagation techniques, Tree improvement & Seed technology
SECOND YEAR - Semester - IV	
PAPER IV	Wood Anatomy, Soil erosion and soil conservation, watershed management, forest legislation and laws
THIRD YEAR - Semester - V	
PAPER – V (A)	DSE -1A: Forest Utilization, Wood Science and Technology, Wild life Management
PAPER – V (B)	DSE -1B: Forest Economics, Forest Business Management
THIRD YEAR - Semester – VI	
PAPER - VI (A)	DSE - 2A: Forest management
PAPER - VI (B)	DSE - 2B: Forest Protection and Pathology
DSE-3: Project	PROJECT

TELANGANA UNIVERSITY, NIZAMABAD –TELANGANA
UNDERGRADUATE COURSES (UNDER CBCS 2021-2022 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-I year
Semester-I Theory syllabus
Paper – I: Forests and Forestry

Unit –I: FORESTS & FORESTRY

1. Forest – various definitions. Classification of forests – based on method of regeneration, age, composition, objects of management, growing stock, ownership and legal status.
2. Biomes of the world – biotic and abiotic characteristics of Tundra, Temperate Coniferous Forests, Deciduous Forests, Tropical Rain Forests, Grasslands, Deserts and water biomes. Comparison between Temperate and Tropical Forests.
3. Forestry – definition, history and development of Indian Forestry. Branches of Forestry and their relationships.

Unit – II: STATE OF THE FORESTS

1. State of the forests – Global, Indian and Telangana scenario.
2. Distribution, species composition and characteristic features of evergreen forests, deciduous forests, shola forests, mangroves and myristica swamp forests. Western Ghats – natural history and significance.
3. Important role of forests – productive, protective, regulatory and recreational roles. Global climate change – role of trees and forests in mitigation. Carbon sequestration – forests as carbon sinks.

Unit – III: AGROFORESTRY

1. Agroforestry: definition and objective. Different agroforestry systems and its classification - structural, functional, socioeconomic and ecological classification.
2. Indian agriculture - its structure and constraints, land use planning.
 - a. Silvoagriculture systems – shifting cultivation, Taungya, growing agricultural crops in combination with commercial trees, plantation agriculture and plantation forestry. Agrosilviculture systems – trees in agricultural fields, alley cropping, trees on farm boundaries, commercial crops under shade of planted trees as well as natural forest.
 - b. Pastoral silvicultural systems – grassland and tree management in the humid, arid and semi-arid regions.
3. Silvopastoral system – protein bank, live fence of fodder trees on hedge, trees and shrubs on pasture. Agrosilvopastoral system – home garden, shelter belts, windbreaks. Multipurpose tree gardens.

Unit – IV: SOCIAL FORESTRY

1. Definition, concept, and objectives. Classification of social forestry – farm forestry, extension forestry and village forestry. Species for social forestry. Role of social forestry to meet the demands for small timber, firewood, fodder and fibre of rural and urban people.
2. Social forestry in the National Forest Policies of India. Organizations involved in social forestry programme – case studies from Telangana.
3. Forestry Extension: Forestry Extension Education – concept, scope and principles. People's participation in forestry extension programmes – community forestry and participatory forestry. Participatory Rural Appraisal techniques. Joint forest management – concept, benefits and impact. Village Forest Council – formation and functions.

References

- Khanna, L.S.1989. Principles and Practice of Silviculture. Khanna Bandhu, Dehra Dun.
- Raj, A. J. and Lal S. B. 2013. Forestry – Principles and Applications. Scientific Publishers, New Delhi
- Agarwal, W.P. Forests in India. Oxford and I.B.H
- Paul, L. Tropical forestry Hand Book. Springer Verlag Publications New York (2Vol)
- S. A. Sha. Forestry for people. ICAR, New Delhi
- Kishwan, J., Pandey, D., Goyal A. K. and Guptha A. K. 2007. India's Forests. MoEF. New Delhi
- State of the Forest Reports. Forest Survey of India, MoEF, Govt. of India
- P.R. Sinha, V.B. Mathur and B. C. Sinha. 2009. India's Green Book. Wildlife Institute of India
- Mather, A.S. 1990. Global forest resources. Belhaven, London
- Persson, R. 1992. World forest resources. Periodical experts, New Delhi.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-I year
Paper – I: Forests and Forestry
Semester-I Practical syllabus

1. Visit a forest area, identify the forest type(s) and study the forest composition
2. Survey the trees/butterflies/birds of the campus and workout diversity indices viz. Simpson's Index, Shannon-Weiner Index, Berger Parker Dominance Index and Similarity indices.
3. Visit minimum five home gardens and prepare a model biodiversity register. Document the associated traditional knowledge.
4. Map the biogeographic zones of India.
5. Agroforestry systems in different agroecological zones- their structural and functional features
6. Visit to on farm agroforestry models
7. Studies on fodder banks and live fences.
8. MPTs and Nitrogen fixing trees in agroforestry
9. Design & Diagnostics exercise in agroforestry- Land capability classification of various topographic regions
10. Visit to industrial plantations. Traditional agroforestry systems in the country and some of the local agroforestry systems
11. Survey of agroforestry practices in local/adjoining areas
12. Exercises on PRA techniques

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-I year
Paper – II: Silviculture
Semester-II Theory syllabus

Unit I: Basics of Silviculture

1. Silviculture systems: definition, scope, classification and detailed study – High forest system – system of concentrated regeneration (clear felling and shelter wood system), system of diffused regeneration (selection and group selection system), accessory system (its types), coppice forest system (its types) and culm selection system in bamboo.
2. Tree monography: Forms of crown, branching, foliage and stem forms like (Tapper, Buttressing, Fluting and Forking). Growth of trees and crops: growth of trees, height growth, diameter growth, crop growth (diameter and height growth in crops) and growth in volume, phenology and growth rings.
3. Crop morphology: differentiation on the basis of age, advantages of even and uneven aged crops, differentiation on the basis of composition, advantages and disadvantages of pure and mixed stands, differentiation of density, crown classification, canopy.

Unit II: Factors effecting Silviculture

1. Edaphic factors: Definition – soil formation – Factors effecting soil formation – soil profile – soil composition – soil texture – soil structure nutrient level of soil – mineral cycle – soil water – various forms of water present in soil – field capacity – soil organic matter – soil reaction or soil pH – forest soil types of India.
2. Climatic factors: solar radiation – effect of light on vegetation – heliophytes – sciophytes – types of precipitation (rainfall, dew, mist, snowfall etc.) – rainfall in India – hydrological cycle microclimate. Effect of temperature on vegetation – frost & its injuries – wind and its effects on vegetation.
3. Biotic factors: Relationship between plant and plant, plant and animal and plant and human (shifting cultivation, encroachment and illicit felling, grazing and browsing, forest fires and its injuries, manipulation). Physiographic factors: Altitude, slope, direction of mountain, exposure to light and valleys effect on vegetation.

Unit III: Silviculture of Trees

1. Silviculture of some economically important species in India – *Acacia nilotica*, *Azadirachta indica*, *Bamboo* spp., *Casuarina equisetifolia*, *Cedrus deodara*, *Dalbergia sisso*, *Dalbergia latifolia*, *Eucalyptus* spp., *Pinus roxburghii*, *Populus* spp., *Pterocarpus marsupium*, *P. santalinus*, *Santalum album*, *Simaruba glaca*, *Swietenia macrophylla*, *Shorea robusta*, *Tectona grandis* and *Terminalia tomentosa*.
2. Silviculture of Mangrove: Habitat and characteristics, silviculture systems for mangroves, importance of mangrove
3. Silviculture of cold desert: characteristics, identification and management of species.

Unit IV: Methods of Regeneration & Propagation

1. Regeneration: Natural – definition, objectives and methods, regeneration through seeds, regeneration protocol for forest plants. Artificial - definition, objectives and methods, selection of site, choice of species, methods of planting, spacing in between plants, Natural vs Artificial regeneration.
2. Propagation: techniques - grafting, cloning, and nursery, Taungya cultivation, fast vs slow growing species, endemic vs exotic species, afforestation – principles and establishment of arboreta. Tending operations: weeding, cleaning, thinning, improvement felling, pruning, climber cutting, singling.
3. Seed production and seed orchards, progeny tests, Tree improvement techniques (clonal multiplication areas - CMA) and variations.

References

- Khanna, L.S.1989. Principles and Practice of Silviculture. Khanna Bandhu, Dehra Dun.
Smith, D. M et al. 1997. The Practice of Silviculture: Applied Forest Ecology. John Willey and Sons. Inc.
Negi, S. S. 1983. General Silviculture. Bishen Singh Mahendra Pal Singh, Dehradun.
Lamprecht, 1986. Silviculture in the Tropics. Verlag Paul Parey, Hamburg und Berlin.
Dwivedi, A. P. 2006. A text book of Silviculture. International Book Distributors.

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B.Sc. (CBCS) Forestry-I year
Paper – II: Silviculture
Semester-II Practical syllabus

1. Analysis of soil texture - Red soils, Black cotton soils and Mixed miscellaneous soils
2. Determination of pH of forest soils - Conventional and Standard method
3. Determination of following basic elements (sodium, potassium, calcium and nitrogen) in forest soils
4. Determination of moisture content, field capacity (Buch Funnel method), organic matter in the forest soil.
5. Estimation of density, abundance and frequency of a species in the forest.
6. Preparation of phenogram of trees from campus.
7. Morphological description and identification of species, seeds, seedlings, planting and strand management practices of *Acacia nilotica*, *Azadirachta indica*, *Casuarina equisetifolia*, *Cedrus deodara*, *Dalbergia sisso*, *Dalbergia latifolia*, *Eucalyptus* spp., *Populus* spp., *Pterocarpus marsupium*, *P. santalinus*, *Simaruba glaca*, *Swietenia macrophylla*, *Shorea robusta*, *Tectona grandis* and *Terminalia tomentosa*.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-II year
Paper – III: Wildlife biology
Semester-III Theory syllabus

UNIT-I: Basics OF Wildlife

1. Animal diversity and general characters of Reptilia, Aves and Mammals. Difference between poisonous and non-poisonous snakes, flying and non-flying birds.
2. Importance of wildlife, wildlife value (positive, negative), position of wildlife in Indian constitution, wildlife trade, An elementary account of zoogeographic distribution of world and India. Migration of animals, predation, age determination of animals, capturing of animals,
3. Classification, description and distribution of wildlife in India, Elementary account on some important species- Lion, Tiger, Bear, Elephant, Rhinoceros, peacock, sambar, black buck, cheeta, musk deer, Kashmir stag, wild ass and great Indian bustard.

Unit III: Wildlife behavior, Crimes and Insects

1. Instinctive behaviour-classical and modern concepts-fixed action pattern and ritualization; Learning-Imprinting-habituation. Analysis of behaviour pattern- taxis, kinesis and reflexes; Biological rhythms and bird migration; Types of animal communications; Courtship, display, sexual selection and parental care in mammals and birds; Social behaviour in animals - Honey bees, Elephants.
2. Wildlife Crimes: Wildlife forensics and its applications in detecting wildlife crimes; Wildlife Toxicology: Types of contaminants, methods of toxicity evaluation, bioconcentration - bioaccumulation and biomagnifications; impacts of pesticides and heavy metals on birds and mammals.
3. Beneficial Insects and their role in forest economy: Scavenger insects, dung beetles; Pollinators, Predatory insects, and parasitic insects on insect pests; control of forest insects. Harmful Insects and their role in forest economy: Insect pests of important trees of India -Teak, Sal and Bamboo; Insects damage to the forest - wood borers - Gall makers - defoliating insects - termites - Seed and cone pests. Monitoring and Forecasting insect pests. Insect Management - Chemical, Physical & Biological.

UNIT-III: Wildlife Management Techniques

1. Wildlife management techniques - food, water, cover management, Wetland improvement, fences and trenches, other habitat improvement measures.
2. Threats to wildlife. Man - wildlife conflicts and mitigation measures. Extinction of animals, causes of extinction, Endangered species - causes, IUCN (International union for conservation of nature) classification (red list categories), examples of threatened species of reptiles, birds and mammals of India, red data book. Endemism.
3. Wildlife census - purpose, techniques. Direct methods (roadside index, dung surveys, water hole survey, calls, fixed-visibility transits, Sample and total counts, indices, encounter rates, block counts, line transect and pug mark count method) and indirect methods (camera traps, Telemetry, visual tagging, marking and ringing in birds and radio caller census).

UNIT-IV: Wildlife conservation

1. In situ conservation - a) National parks (important national parks like Corbett, Kanha, Ranthambor, Bandipur, Gir, Khaziranga national parks. b) Sanctuaries of India (Periyar, Sariska, Nagarjuna sagar sanctuary, Manas wildlife sanctuary). c) Biosphere reserves of India. Hotspots in India.
2. Ex situ conservation - zoo parks and safari parks, Captive breeding for Conservation, Gene bank.
3. Special projects wildlife conservation like Project tiger, Musk deer project, Gir Lion project, Project Elephant. Wildlife corridors. Agencies involved in wildlife conservation, Wildlife Institute of India (WII), World Wildlife Fund for nature (WWF), Bombay National history society (BNHS), Wildlife preservation society of India (WLPSI), Conservation on International Trade in Endangered Species (CITES) and TRAFFIC, Indian Board for Wildlife (IBWL).

References

- Dasmann, R.F. 1982. Wildlife Biology. Wiley Pub. New York.
- Reena Mathur. 1985. Animal Behaviour. Oxford University Press
- Gee EP. 2000. The wildlife of India. Harper Collins Publication.
- Johsingh AJT. (Ed.). 2003. The Mammals of South Asia: Ecology, Behaviour and Conservation. Permanent Black.
- Prater, S.H. 1971. The Book of Indian Animals. Oxford University press, Bombay.
- Vivek Menon. 2003. Field Guide to Indian Mammals. Penguin Books, India.
- Grimmet, R. Inskipp T and Inskipp, I. 2000. Pocket Guide to the of Birds of Indian sub-continent. Christopher Helm series.
- Grimmet, R. Inskipp, T and Nameer, P.O. 2007. Birds of southern India, BNHS series.
- Hunter L Malcom. 1996. Conservation Biology. Blackwell Science. Chicago

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Paper – III: Wildlife biology
Semester-III Practical syllabus

1. Wildlife census
 - a. Direct methods: i. Roadside index, ii. Dung surveys and calls, iii. Water hole surveys, iv. Fixed-visibility transect, v. Pug marks
 - b. Indirect methods: i. Camera traps, ii. Radio caller census
2. Bird watching
 - i. Nearby water bodies, ii. Nearby forest areas
3. Identification of indirect evidences – scat, pellet, dung, droppings
4. Population estimation of herpeto fauna – pit fall trap
5. Call Identification of common birds – any five birds
6. Identification of venomous and non-venomous south Indian snakes
7. Insect damages – defoliator, wood borer
8. Identification of beneficial and destructive insects – Honey bee, butterfly, Termite, Rhinoceros beetle
9. Tour monograph/project report of visited wildlife areas

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Skill Enhancement Course

SEC – 1

2 credits

Plantation Forestry

Unit - I

1. Plantations-definition and scope - History of plantations - Development of plantation forestry - present status in national and international scenario - Plantation organization and structure - Plantation characteristics - species composition-age class distribution – stocking.
2. Land and plantation development – National land use policy - land use for forestry - Social and economic factors in plantation development finance - economics of plantation development - land availability – labour - infrastructure, economic, marketing, social and cultural effects - Plantation planning-National and regional planning-project appraisal and project implementation – feasibility studies.
3. Plantation silviculture - Choice of species - concept of fast growth - exotics vs. indigenous - traditional vs. intensive forest management - Plantation establishment - essentials ground preparation - Planting - planting stock- planting pattern – spacing - general planting rules- protection and after care of newly planted seedlings. - Plantation maintenance- death of seedling weed control – cleaning, singling, pruning.

Unit - II

1. Nutrition in plantations- nutrient deficiencies, symptoms of deficiency- use of fertilizers- - Major pest and disease in plantations- sanitation and control measures. Dynamics of stand growth - stand density management in plantations- spacing, planting density regulation - Thinning regimes- improvement fellings - CCF-MCA - Site quality evaluation - stand basal area, site index concept in plantation forestry - plantation productivity assessment - growing stock assessment MAI of different plantations
2. Modern concepts in plantation forestry. Plantation records - plantation journal-sustainability of plantations - fast growing plantations-myths and reality- Industrial plantation- paper and pulp wood- Match wood plantation- plywood plantation Plantations yielding NTFPs - Energy plantation- high density short rotation plantations- petro-crops-energy from biomass.
3. Strip plantation-road side plantation, canal side plantation- railway side plantation- Clonal plantations- development and management of clonal plantation- Plantations as potential carbon sinks - C Sequestration, C Substitution and C Conservation functions; LULUCF and REDD concepts, AR-CDM concepts

Suggested Readings:

- Evans, J. 1992. Plantation Forestry in the Tropics, 2nd edition. Oxford, UK, Clarendon Press.
- Evans, J. and Turnbull, J.W. 2004. Plantation Forestry in the Tropics: The Role, Silviculture and Use of Planted Forests for Industrial, Social, Environmental and Agroforestry Purposes. OUP Oxford
- Nambiar, E.K.S., Cossalter, C and Tiarks.A. 1998. Site Management and Productivity in Tropical Plantation Forests. Workshop Proceedings, South Africa.
- Nambiar, E.K.S. and Brown, A.G. 1997. Management of Soil, Nutrients and Water in Tropical Plantation Forests. Australian Centre for Internat. Agricultural Research.
- Bowen, G.D., E. K. S. Nambiar, E.K.S 1984. Nutrition on Plantation Forests. Academic Press, 1984 - Nature
- Suzuki, K., Ishii, K., Sakurai, S. and Sasaki, S. 2006. Plantation Forestry in the Tropics. Springer Tokyo.
- Krishnapillay.B. 2000. Silviculture and Management of teak plantations. Unasy

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B.Sc. (CBCS) Forestry-II year
Skill Enhancement Course

SEC – 2

2 credits

Marketing and Certification of Forest Products

Unit - I

1. Types of markets for timber and non-timber forest produce, market locations of timber and non-timber forest produce and their features. Demand forecasts. Price determination in timber and non-timber forest produce.
2. Economic features of specialized timber markets in terms of degree and type of competition in buying and selling, price spreads across different channels of marketing, costs of marketing functions involved like pre-commercial thinning, commercial thinning, harvesting, hauling, sawing, transportation, treatment of wood, carpentry, and other processing activities involved in teakwood, rosewood, matchwood, pulpwood, sandalwood, veneers; type and degree of competition in market for services of saw mill and other intermediate wood processing industries.
3. Domestic demand and trade in timber and non-timber forest products. International demand and trade in timber and non-timber forest produce. Forests produce price analysis.

Unit - II

1. Market integration and market inefficiencies in timber, non-timber forest produce and measures to check in efficiencies, role of cooperative societies in marketing of timber and non-timber forest produce.
2. Economic policy and regulations of international timber trade. Essentials of World Trade Organization, GATT, Dunkel proposals, Intellectual Property Rights and Patenting. International Timber Trade Organization (ITTO). Marketing management in forest produce.
3. Definition of forest certification. Forest Certification process and methods – Advantages and Disadvantages. Certification schemes in operation. Forest Stewardship Council (FSC), Programme for Endorsement of Forest Certification Schemes (PEFC) etc. CIFOR certification tool kit. Indian scenario in certification.

Suggested Reading:

- Gray, J. W. 1993. Forest resource systems in developing countries. Food and agricultural organization. Rome.
- ITTO. [International Tropical Timber Organisation]. 1993. The economic linkages between international trade in tropical timber and sustainable management of tropical forests. London environmental economic centre, International Institute for Environment and Development, London, UK.
- ITTO. [International Tropical Timber Organisation]. 2012. Annual review and assessment of the world timber situation, Yogyakarta, Indonesia.
- Kula, E. 1996. The economics of forestry: Modern theory and practice. Timber press, Portland, Oregon.
- Muraleedharan, P. K. Subramanian, K. K., and Pillai, P. P. 1998. Basic readings in forest economics. Kerala Forest Research Institute and Ford Foundation, Thrissur, Kerala.
- Tewari, D. N. 1995. Marketing and trade of forest produce; International Book Distributors (Book Sellers & Publishers), Dehradun, India.
- Bass, S. Introducing forest certification. 1996. A report prepared by the Forest Certification Advisory Group (FCAG) for DGVII of the European Commission. European Forest Institute, Discussion Paper 1.
- Details available at: <http://www.giz.de/Themen/de/dokumente/end28-inenpenennt-certification-verification-forest-manage.pdf>.
- Bass, S., Thornber, K., Markopoulos, M., Roberts, S. and Grieg-gran, M. 2001. Certification's Impact on forests, stakeholders and supply changes. International Institute for Environment and Development. London.
- Conroy, M. E. 2007. Branded! How the "certification revolution" is transforming global corporations. New Society publishers, Gabriola Island, BC.
- Gupta, H. S., Yadav, M., Sharma, D. K. and Singh, A. M. 2013. Ensuring sustainability in forestry: certification of forests. TERI, New Delhi.

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Semester-IV Theory syllabus
Paper – IV: Forest Mensuration & Management

Unit I: Forest Mensuration

1. Forest Mensuration - definition, objectives and scope. Accuracy of forest measurements. Diameter and Girth measurement of trees: Units of measurement. Breast height measurement – advantages and standard rules. Measuring diameter and girth - Instruments used - merits and demerits. Measurement of upper stem diameter – instruments used. Bark thickness – conversion of GOB to GUB and DOB to DUB.
2. Tree height measurement: Tree height – definitions of total height, bole height, commercial bole height, crown point, crown height and crown length. Methods of measurement of height – ocular - non instrumental and instrumental methods – based on geometric principles and trigonometric principles. Measurement of cross sectional area, basal area, leaf area. Tree stem form - Metzger's theory - form factor-types of form factor-form height- form quotient - form class.
3. Tree volume measurement: Volume measurements of trees - Definitions of Commercial volume, standard stem timber volume, standard stem small timber volume. Calculation of volume of felled trees - Smalian's formula - Huber's formula - Prismoidal or Newton's formula - Quarter girth formula. Volume of standing trees – ocular, partly ocular - direct and indirect measurements. Volume tables - classification of volume tables. Measurement of branch wood and root wood - solid volume and stacked volume. Determination of age of trees. Increment - classification of increment- relationship between CAI and MAI. Increment percent - Pressler's formula, quality and price increment, effect of thinning on volume increment. Stump analysis and stem analysis. Measurement of tree crops - crop diameter, crop height, crop age and crop volume.

UNIT-II: Forest Management

1. Forest Management - Definition, scope, objects and principles. Art and science of forest management. Forest management in relation to industrial and agricultural management. Organization and control of forest property and personnel. Distribution of age gradations and age classes - definitions, normal age gradations/classes in regular forests and irregular forests.
2. Normal forest - definition, basic factors of normality and kinds of abnormality. Growing stock - definition, normal growing stock (NGS) – in clear felling system, in shelter wood system and selection system. Relation between growing stock and yield. Rotation – types, factors determining length of rotation and choice of rotation. Concepts of yield – sustained yield and progressive yield. Yield regulation – definition and objectives. Yield regulation based on area, volume, area and volume. Types of yield - intermediate and final. Yield regulation in regular forest and irregular forest.
3. Classification of forest organization: geographical and climatic classification, functional classification, legal classification, territorial classification, administrative classification and management classification: working circle, felling series (coupes and cutting section), periodic blocks, felling cycle. Joint forest management – concept, benefits and impact. Success stories from Indian scenario. Village Forest Council – formation and functions.

UNIT-III: Forest Working Plan and Survey

1. Working Plan – scope and purpose. Formulation and drawing of working plan. period of working plan. Field work – survey, enumeration and mapping. preliminary working plan report, secondary - preliminary report, field work, stock mapping, annual plan preparation. Standard format of a working plan.
2. Forest surveying – definition and objectives. Classification of surveying. Chain survey – types and procedures. Traversing, triangulation, survey stations, base line, check and tie lines, ranging of survey lines, offsets and their types. Chaining across obstacles. Compass surveying – Procedure. Chain and Compass survey. Plain Table Survey – scope, different methods and procedures, advantages and disadvantages, applications in forestry. Topographical survey.
3. Levelling - terms used, types of level. Theodolite and its uses. Contour surveying. Maps and map reading. Importance of maps in forestry. Aerial photography and applications in forestry. Remote sensing- definition, application, advantages, energy

sources. Geography information system (GIS) - advantages, components, application. Global positioning system (GPS) - advantages, segments and applications.

Unit-IV: Forest Engineering

1. Forest Engineering - basic principles of forest engineering, building materials (lime, stone), manufacturing of bricks, properties of good sand, cement - types, manufacturing, mortar - types, RCC, tiles, plastering, pointing, selection of site for construction, foundation, walls, arches, roof - types, roofing material, doors and windows.

2. Roads: Introduction - classification of forest roads. Cross section of roads: sealing coat - outer coat - inner coat - soling - sub base - sub grade - shoulder - camber - gradient - kinds of gradients. Road alignment and design - drainage of roads - curves - breast wall - retaining wall - road setting - maintenance of roads.

3. Bridges: Site selection for bridge construction - types of bridge - ford - road dam - irish bridge - causeways - simple wooden bridge - cantilever bridge - suspension bridge. Culverts - design - types of culverts - pipe culvert - box culvert - arched culvert - timber pole culvert - masonry arched culvert. Abutments - types of abutments - masonry abutments - timber bank seat abutment - timer post abutment. Piers - types of piers - pile piers - single trestle piers - double trestle piers - masonry piers - crib piers. and constructions.

Reference books

Forest management by Ram prakash.

Forest management by Lal.

Forest management by Ostmasten.

Forest working plan by Bishensingh, Mahendra pal singh.

Forest working plan and yield regulation by S.S. Negi.

Introduction to remote sensing by James B. Camphell.

Remote sensing and image interpretation by Lilles and T.M. Keifer.

Remote sensing and forest surveys by M.K. Sharma.

The GIS book by George Korte.

Introduction to geographical information system by Ian Heywood, D. Sarah Cornelius, Steve carver 2006

Practical syllabus

1. Instruments used in diameter and girth measurement
 2. Measurement of bark thickness
 3. Conversion of GOB into GUB and DOB into DUB
 4. Non-instrumental methods of tree height measurements
 5. Instrumental methods of tree height measurements – tangent method and sine method
 6. Measurement of tree height using Christen's Hypsometer, Smythies Hypsometer, Modified Smythies Hypsometer, Brandis Hypsometer
 7. Measurement of tree height using Haga Altimeter, Ravi Altimeter
 8. Calculation of volume of a log
 9. Determination of age of a tree using Increment Borer/by three periodic measurements
 10. Preparation of stock map
 11. Standard format of working plan
 12. Plotting the given plot area on drawing sheet.
 13. Map and map reading (Compare satellite vs topographic map)
 14. Survey the given plot area: Chain survey method, Plain table survey, Prismatic compass survey.
 15. Estimating the area in acres, hectares, square feets and square yards.
 16. Estimating the cost for construction of
 - a. Lying down forest roads
 - b. Fencing forest area
 - c. Estimating water content in tanks
 - d. Construction of tanks
- Visiting forest institutes like forest survey of India (FSI), Indian institute of remote sensing (IIRS), Indian institute of forest management (IIFM).
Tour monograph of visited institutes/project work.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-II year
Semester-IV Theory syllabus
Skill Enhancement Course

SEC – 3

2 credits

Eco-Tourism

Unit - I

1. Eco tourism - study history of tourism, identify various forms of tourism and evolution of ecotourism. Dimensions of tourism and essential conditions for tourism to occur. Differences between tourism components. Mass tourism versus ecotourism.
2. Understand dimensions of ecotourism and the criteria to qualify for ecotourism. Quebec declaration. Different forms of ecotourism like hard and soft ecotourism. Ecotourism indicators and conceptual differences between developing and developed countries.
3. Organized tours and Free Independent Travelers. World Tourism Organization. Problems with definition of ecotourism and criticisms. International organizations and NGOs promoting ecotourism. Sociological implications of eco-tourism.

Unit – II

1. Protected areas in India - Ecotourism- a worldwide view. Ecotourism in Indian context. Planning ecotourism in protected areas. Visitor management in ecotourism areas – zoning, carrying capacity. Participation of local people in ecotourism. Conflicts in PA's. Ecotourism for sustainable development of PA's.
2. New directions in ecotourism industry. Ecotourism in practice in important PA's of India – case studies of Periyar Tiger Reserve, Keoladeo National Park, Kanha National Park and Jim Corbet National Park, Project Tiger Research, Betla and Sunderbans Tiger Reserve. Limitations and problems of ecotourism.
3. Ecotourism as a way for sustainable management of natural resources. Local livelihoods and eco-tourism like nomadic grazing, Agro-pastoralism.

Suggested Readings

- Baker CP. 1996. World Travel: A Guide to International Eco Journeys. Warner Books.
Honey M. 1998. Ecotourism and Sustainable Development. Iceland Press.
Luck M & Kirstges T. 2002. Global Ecotourism Policies and Case Studies. Channel View Publ.
Neale G. 1999. Green Travel Guide. Earth Scan.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-II year
Semester-IV Theory syllabus
Skill Enhancement Course

SEC – 4

2 credits

Urban Forestry

Unit - I

Urban forestry: Introduction and concept of urban forestry.– definition and scope – uses of urban forests, Management of urban and peri-urban forest. Importance of urban forestry. Urban forestry benefits, climatic amelioration, engineering, architectural and recreational uses of urban forestry.

2. Areas available for urban forestry and trees suitable for each such areas in landscaping, desirable characteristics of trees for urban planting, management of urban forest and tree guards.

3. Whole tree transplantation and its technique, responses and adaptation of trees to pollution, climatic variations and urban forests, tree maintenance, tree felling in cities, beneficiaries of products obtained from urban forests.

Unit – II

1. Specialized gardens - butterfly, water, bog or marsh, terrace, roof, Sunken, Indoor and rock. Planning and planting programmes in institutional and industrial complexes, roads, bridges, parking area and other structures.

2. Arboriculture, and its importance in urban forestry. Management of tree structure and canopy, Architecture.

3. Vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops.

Suggested Reading:

Douglar, J. Hort, R. A and Ranganadhan, S. (1982). Forest Farming. Natraj Publications, Dehradun.

Gopikumar K. (2008). Arboriculture Principles and Practices. Published by Khanna Bandhu, Dehradun

Hamm, W.E and Cale, D.N.(1987). Wild Land Recreation, John Wiley and Sons, New York.

Miller, R.W.(1988). Urban Forestry. Prentice Hall International Ltd. London

Singh, S.P.(1986). Planting of Trees. B.R. Publishing corporation, Delhi.

Gordon Bradley (1995). Urban Forest Landscapes: Integrating Multidisciplinary Perspectives.

Journals: Urban Forestry and Urban Greening, An International Journal aimed at presenting high-quality research with urban and peri-urban woody and non-woody vegetation and its use, planning, design, Elsevier Publications.

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UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)**

**FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V Theory syllabus
Paper – V (A): Forest Utilization
(DSE – 1: ELECTIVE)**

Theory: 4 Hours/Week; Credits-4, Marks: 100 (Internal: 20; External: 80)

Unit - I: Forest harvesting practices

1. Felling and conversion - felling with axe alone - felling with axe and saw - felling with saw alone, Mechanized harvesting systems – felling equipments, extraction equipments and loading equipments. Methods of felling and felling rules, Log making - purposes of log making - factors that determine log lengths. Reduced Impact Logging.
2. Transport: modes of major transportation, Transportation by land: carriage by men - animals - carts - dragging - rolling - sliding – forest tramways - motor transport. Transportation by water: floating - telescopic floating - river floating - rafting - types of rafts - booms - types of boom - wet slides, Overhead transportation - single ropes - double or multiple ropes,
3. Storage of timber - stacking of wood, Disposal and sale of forest produce, Systems of extraction and disposal: felling and extraction by government agency - felling and extraction by purchasers alone - felling and extraction by government and purchases combined. System of sale of forest produces: lump sum sale - payment on out turn. Methods of sale: sale by private bargain - sale to the highest bidder - sale by royalty or fixed tariff.

Unit – II: Non-timber forest products (NTFP'S)

1. Non-timber forest products - (NTFP'S) – Definition and their importance in rural and industrial economy of India and Telangana. Important NTFP in India and Telangana viz. Fodder (grasses and tree leaves). Canes and bamboos – derived products and uses. Essential oils – classification, methods of extraction and uses. Non-essential oils - occurrence, classification, methods of extraction and uses.
2. Gums, resins and Oleoresins - classification, sources, extraction and uses. Tans - classification, source plants and uses. Dyes – classification, sources of dyes and uses. Fibers and flosses – classification, source plants and uses.
3. Animal products – Honey and wax, Lac and silk – their cultivation methods, extraction and uses. Miscellaneous products - Wild fruits, leaves, latex, poisons, mineral products, Beedi leaves - sources, collection and processing. Cutch and Katha - extraction and uses.

Unit - III: Wood Science

1. Wood definition: physical - chemical - mechanical properties – uses, Anatomical structure of wood - pith - heartwood - sapwood - annual rings - bark - grain and texture - vessel or pores - tyloses - fibers - tracheids - pith flecks - rays - ripple marks - inter cellular canals, Classification of wood,
2. Wood defects: natural defects - defects other than natural: seasoning defects - defects due to conversion and wood working - defect resulting from the activities of external agents - defect due to drying
3. Wood seasoning: purpose and scope - advantages - moisture in wood: free water - bound water - hygroscopic or absorbed water - moisture content - fiber saturation point - equilibrium moisture Content. General principles of seasoning, seasoning behavior of woods, Methods of seasoning, Air seasoning, Kiln seasoning (steam heated and electric kilns). Principle of drying of wood: temperature - relative humidity - air circulation. Solar dehumidification.

Unit – IV: Wood preservation and Wood Based Industries

1. Wood preservation - objectives and advantages, Wood preservatives - properties - classification - oil type - water soluble preservatives – organic solvent type - fire retardants - preparation of material for wood preservation. Methods of application of preservatives:
 - a. Non pressure methods (Soaking process, Diffusion process, Steeping process , Hot soaking, Heating and Cooling, Boucherie and Modified Boucherie method)
 - b. Pressure methods- Full cell process, Empty cell process, Lowry process, Rueping process-alternate pressure method.

c. Special treatments: Boulton process - steaming cum vacuum process - charring and spraying - ground line treatment in situ - pudding treatment.

2. Composite wood: plywood - laminated wood - core boards - sandwich board - fiber board - particle board - improved wood - impregnated wood - heat stabilized wood, compressed wood, compregnated wood, heat stabilized wood, chemically modified wood. Pulp and paper: raw materials - pulp making process - mechanical and chemical pulping - pulp cleaning - bleaching - beating - sizing - loading - colouring - formation of sheets. Rayon - types - uses - manufacturing process: steeping - shredding - aging - xanthation - dissolving - filtration - ripening - spinning - washing - leaching. Timber identification. Adhesive manufacturing and uses- Phenol formaldehyde resin-PF, Urea formaldehyde resin-UF, Melamine formaldehyde resin -MF.

3. Wood Based Industries

a. Timber and sawn wood industries, Charcoal, Pulp and paper industry - introduction and raw materials, Match industries - species used.

b. Other wood-based industries - Packing case, dendro - biomass power generation industries and value addition industries. Constraints in wood based industries - wood demand and supply.

c. Measures for development of wood based industries - technological measures, precision silviculture technology, value addition technology, design and promotion of contract farming.

Present status of composite wood industry in India - utilization of plantation wood - Problems and possibilities. Energy plantation.

Reference books

A Handbook of *Forest Utilization* by Tribhuwan Mehta

Break through approach for Forest Services by K. Manikandan and Prabhu.

Principles of Wood Science and Technology by Kollman Vol. I, Kollman Vol. II, Franz F.P, Cote, Wilferd A.Jr.

Additive manufacturing by Gibron (et al) 2015.

Forest Utilization by Robert Scott Trop, Carl Alwin Schench.

Mehta, T. 1981. A Handbook of Forest Utilization. International Book Distributors.

John G. Haygreen, Jim L. Bowyer. 1996. Forest Products and Wood Science, an Introduction.

Rao, P.S. 1988. A Handbook on Indian Wood and Wood Panels, Solid Wood. Oxford University Press.

Brown HP. 1985. A Manual of Indian Wood Technology.

Desch, H. E and Dinwoodie, J.M. 1981. Timber: Its Structure, Properties and Utilization. The Macmillan Press.

Indian Forest Utilization. Vol I and II. Forest Research Institute Dehra Dun

Rydhom S.A. 1965. Pulping process inter Science Publishers. New York

K.W. Brit. Hand Book of pulp and paper technology. C.B.S. Publication New Delhi.

Krishnamurthy, T. Minor Forest Products of India. Oxford & IBH Publishing Co. Pvt. Ltd.

Sharma, L.C. 1988. The Indian Pulp and Paper Industry at a glance. Bishen Singh Mahendra Pal Singh, Dehradun.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V Practical syllabus
Paper – V (A): Forest Utilization
(DSE – 1: ELECTIVE)

Practical: 3 Hours/Week; Credits-1, Marks: 50

1. Wood moisture and properties study
 - i. Moisture content
 - ii. Shrinkage
 - iii. Swelling

2. Adhesive manufacturing
 - i. Phenol formaldehyde
 - ii. Urea formaldehyde
 - iii. Melamine formaldehyde

3. Composite wood product preparation
 - i. Paper and pulp preparation
 - ii. Particle board
 - iii. Plywood manufacturing
 - iv. Fiber board manufacturing
 - v. Block board and flush door manufacturing

4. Manufacture of shellac, Cutch and Katha, Turpentine and Resin Tapping

5. Minor forest product specimens: Gums, fibers and flosses, cutch and katha, Lac and shellac, charcoal.

8. Visits to the following wood based industries to learn the manufacturing procedures adopted and raw materials used: Plywood factory, Paper mill, Match industry, Saw mill and Furniture factory

9. Tour monograph/project work of visiting forest based industries and wildlife areas

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UNDERGRADUATE COURSES (UNDER CBCS 2021-2022 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V Theory syllabus
Paper – V (B): Forest Economics and Business Management
(DSE – 1: ELECTIVE)

Theory: 4 Hours/Week; Credits-4, Marks: 100 (Internal: 20; External: 80)

UNIT - I: Forest Economics - I

1. Fundamental principles-cost benefits analysis; Estimation of demand and supply; Analysis of trends in the national and international market and changes in the production and consumption patterns; Assessments and projection of market structures.
2. Role of private sector and co-operatives; role of corporate financing.
3. Socio-economic analysis of forest productivity and attitudes; Valuation of forest goods and service.

UNIT - II: Forest Economics - II

1. Elasticity of demand (Price elasticity, Cross elasticity, Income elasticity, Advertising or promotional elasticity of demand) - Factors affecting demand function; Market demand and demand for forest products.
2. Supply- Law of supply -Elasticity- factors affecting supply - supply of forest products. Application of concepts specific to forestry (demand, supply and prices of forest products).
3. Valuation of forest goods and services- market based and non-market based, use values, non-use values and valuation methods like CVM and TCM.

UNIT - III: Forest Business Management - I

1. Nature and scope of business management as related to forestry forms of business organization, vertical and horizontal integration. Key functions and areas of management in forestry business. Approaches to management.
2. Production planning-land use planning, marginal analysis; break even analysis; methods, Business size and Economics of scale.
3. Production control-control information, Control charts, Physical records, role of good record keeping.

UNIT - IV: Forest Business Management - II

1. **Financial planning**-sources of finance, Returns to capital, Repayment schedules, Depreciation, capital investment appraisal, budgeting techniques.
2. **Financial control**- Cash analysis, Financial statements and Financial ratios. Work planning- Personal management, Labor problems and measurements, Work allocation, Raising labor productivity
3. **Staff control**- Work progress charts, Supervisory management, Leadership and leadership styles, Good labor relations, Training needs, Employee records and reward structures. Marketing strategies, Planning and control.

Reference book

Forest Economics by Peter Breck-2014

Forest Economics by Daowei Zhang and Pearse Peter

Forest Economics and evaluation by Madhan mohan pant

Entrepreneurship and Management in Forestry and Wood Processing by Franz

Schmithüsen, Bastian Kaiser, Albin Schmidhauser, Stephan Mellinghoff, Karoline

Perchthaler, Alfred W. Kammerhofer

Forest Business Management by Stephan Mellinghoff, Karoline Perchaler

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UNDERGRADUATE COURSES (UNDER CBCS 2021-2022 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V: Practical syllabus
Paper – V (B): Forest Economics and Business Management
(DSE – 1: ELECTIVE)
Practical: 3 Hours/Week; Credits-1, Marks: 50

1. Exercises on estimating demand and supply of important commercial forest products.
2. Marginal analysis and break even analysis
 - i. Inventory methods
 - ii. Physical records in forest business
3. Preparation of cash analysis
 - i. Account books
 - ii. Financial statements
 - iii. Evaluating the financial performance of the business through analysis of financial statements and ratios.
4. Capital investment appraisal in forestry projects
 - i. Techniques of cash flow and gross margin budgeting
 - ii. Company machinery purchase with machinery rental cost
5. Constructing a plan for overall labor needs and labor supply
 - i. Situation in forestry enterprises
 - ii. Preparation of work progress charts
 - iii. Interaction with village forest development societies (VFDS)
 - iv. Co-operatives and forest business firms
6. Project work

Practical Question Bank

(50 M)

1. Exercises on estimating demand and supply of important commercial forest products.
(6M)
2. Marginal analysis and break even analysis (6M)
3. Preparation of cash analysis (8M)
4. Capital investment appraisal in forestry projects (7M)
5. Constructing a plan for overall labour needs and labour supply (8M)
6. Project work (10 M)
7. Record (5M)

**TELANGANA UNIVERSITY, NIZAMABAD –TELANGANA
UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)**

**FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V Theory syllabus
Paper – V (C): Watershed Management
(DSE – 1: ELECTIVE)**

Theory: 4 Hours/Week; Credits-4, Marks: 100 (Internal: 20; External: 80)

Unit - I

1. Hydrology and hydrological cycle on the earth, hydrologic properties, infiltration, runoff, water holding capacity of soils, free water, capillary water, hygroscopic water, ground water, evapotranspiration, water yield, interception by stem flow through fall, study of hydrographs, Hydrological cycle and characteristics of small and medium watersheds precipitation, total and peak, soil moisture, ground water.
2. Precipitation - rain and snow hydrology. Surface water, run off, factor affecting runoff, runoff estimation by rational method. Runoff water measuring devices. Rainfall: Types of Rainfall, Orographic precipitation, Cyclonic precipitation, Convective precipitation. Rainfall measurement - Arithmetic mean, Thiessen polygon method, Isohyetal method.
3. Water harvesting - Methods of water harvesting, Rain Water Harvesting Ground water recharge. Direct method of Water harvesting - Surface recharge, Flooding, Basins or Percolation tank, Recharge pit, Stream augmentation, Ditch and Furrow system. Sub-Surface recharge - Recharge Well, Recharge pit, Dug well. Indirect method of Water harvesting.

Unit - II

1. Watershed management - Watershed definition and concepts, Historical background, Multiple use concept, Watershed characteristics, Watershed classification and condition, Objectives of watershed management, Principle of watershed management, Components of watershed, Steps in watershed management, Benefits of watershed management.
2. Causes for watershed deterioration, Role of watershed development in river channel stabilization, Role of watershed development in landslide controls, Role of watershed development in rehabilitation of degraded areas, The Role of watershed development in avalanche control, Role of watershed development in torrent control
3. Employment and Income generation, Sustainability and Equity issues. Formulation of watershed projects (micro and macro watershed). Components of natural resources for watershed management. Preparation techniques for micro plan of watershed.

Unit – III

1. Watershed management - practices for sustainable productivity, water harvesting techniques and structures – farm ponds, check dams and earthen dams. Water well, aquifers. Waterways their design, layout, construction, stabilization and maintenance.
2. Water application methods – surface, sub-surface, drip and sprinkler irrigation system. Drainage – types of drainage system, their selection, design and installation and maintenance. Importance of forests in water conservation, Grassland management.
3. Compass, Surveying, Plane table surveying, Leveling, Preparation of contour maps of watershed. Terraces and bunds- types & design. Soil and water conservation and water harvesting structures – types & design. Sedimentation- sources, estimation of sediment bank treatment techniques.

Unit - IV

1. Soil water energy concept, movement, availability and measurement. Soil erosion, Universal soil loss equation, Agronomical and engineering practices for soil and water conservation, Recharging of water springs. Forest treatment and water yield. Water resource development, water availability, pressurized irrigation crop water requirements and water use efficiency.
2. Degradation of watershed, soil and water erosion and their conservation measures. Hazards in watershed - flood, drought, sedimentation and their management. Monitoring and evaluation of watershed projects. Role of forests in watershed management. Role of

community in watershed management. Holistic approach of Integrated watershed management. Impact of deforestation on watershed and hydrologic cycle. Application of remote sensing and GIS tools in watershed management.

3. Wasteland Management: Objectives, components, runoff, factors affecting runoff, stream flow and stream gauging. Sedimentation, factors affecting sedimentation, flood and its control measures. Afforestation and forest management in wasteland areas.

Suggested Readings

Dhruva Narayana V. V. 1993. Soil and Water Conservation Research in India, ICAR, New Delhi

Dhruva Narayana V. V., G. Sastry and U. S. Patnaik. 1997. Watershed Management. Indian Council of Agricultural Research, New Delhi, 176 p

Gurmail Singh et al., 1988. Manual of Soil and Water Conservation. Oxford IBH Publishing Co. New Delhi

Michael, A.M. 2008. Irrigation theory and practice, Vikas Publishing House Pvt Ltd. 768p

Michael, A.M. and Ojha, T.P. (1966). Principles of Agricultural Engineering, Jain Brothers, Jodhpur.

Murthy, JVS (1998). Watershed Management, New Age International, New Delhi.

Murthy, V.V.N. (1985). Land and water management engineering. Kalyani Publishers, New Delhi.

Subramanya, K. (2006). Engineering hydrology, Tata McGraw Hill publication.

USDA 1961. A Manual on Conservation of Soil and Water. Oxford and IBH Publishing Company.

Dutta SK. 1986. Soil Conservation and Land Management. International Book Distributors, Dehra Dun.

Hamilton IS. 1987. Forest and Watershed Development and Conservation in Asia and the Pacific. International Book Distributors, Dehra Dun.

Hamilton IS. 1988. Tropical Forest Watersheds. Hydrologic and Soil Response to Major Uses of Conservation. International Book Distributors, Dehra Dun.

Moorthy VVN. 1990. Land and Water Management. Kalyani.

Oswal MC. 1999. Watershed Management (For Dryland Agriculture), Associated Publishing Co., New Delhi.

Rajora R. 1998. Integrated Watershed Management. Ravat Publ., New Delhi. Rama Rao. 1980. Soil Conservation. Standard Book Depot, Bangalore.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V Practical syllabus
Paper – V (C): Watershed Management
(DSE – 1: ELECTIVE)

1. Survey of watershed, Preparation of micro-plan and planning of watershed for effective implementation.
2. Preparation of contour maps, Estimation of earth work, Design of check dams, Acquaintance with water lifting devices,
3. Study of hydrological equipments
4. Measurement and analysis of rainfall data
5. Estimation of runoff using rational formula
6. Preparation, use and analysis of hydrograph
7. Measurement of evaporation by different methods;
8. Visit to forest watersheds to study the effect of forest treatment on hydrological properties.

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-V
Generic Elective (GE)

Forest Ecology & Dendrology

Theory: 4 Hours/Week; Credits-4, Marks: 100 (Internal: 20; External: 80)

Unit - I

1. Introduction, division, scope and importance of ecology and basic concept of forest ecology. Ecosystem, structure, components and important ecosystems (forest, agriculture, grassland, desert and pond ecosystem). Major forest Ecosystem. Forest environment - major abiotic and biotic components and their interaction, trophic levels, food webs, ecological pyramids and energy flow.
2. Forest communities: Vegetation analysis, biomass, net primary productivity, litter fall, forest floor and nutrient cycling. Climatic factors: Solar radiation, temperature, precipitation, rainfall, snow, frost and its damages, moisture, atmospheric humidity and wind.
3. Topographic factors, biotic factors: influence of plant, competition, parasite, epiphytes, climbers, weeds, influence of wild animals, influence of man and his domestic animals. Succession, causes, mechanism of succession, various types of succession and climatic climax, ecological adaptation and evolution.

Unit - II

1. Advanced topics in forest ecology including forest population, forest community dynamics, forest community structure and analysis, forest productivity on a global scale, ecology of forest landscapes spatial heterogeneity; Hierarchy issues in ecology.
2. Conservation of natural resources (hotspot areas, wildlife sanctuaries, national parks, biosphere reserve). Global warming and forests. Green House Effect and its consequences. Ozone depletion. Conservations laws and acts.
3. Forest genetics resources of India: timber and non timber species. Survey exploration and sampling strategies. Documentation and evaluation of forests genetical resources (FGR), Biological diversity and its significance to sustainable use. Handling and storage of FGR. Intellectual property rights. Quarantine laws and FGR exchange.

Unit -III

1. Population ecology - definition, population dynamics and carrying capacity, preparation of life table and its importance in forest management. Community ecology- species interactions, ecological succession, terminology, basic concepts, theories of succession- climax vegetation types, forest management and succession.
2. Island Biogeography. Autoecology of important tree species. Perturbation ecology – definition, levels of study, distribution of diversity in life forms, hotspots of biodiversity, measurement of diversity and diversity indices.
3. Principles of conservation biology, Genetic and evolutionary principles in conservation. Biosphere concept. Conservation – efforts in India and worldwide. Introduction to IPR and quarantine laws.

Unit - IV

1. Introduction to dendrology – history, significance of dendrological studies and applications in tree identification; Botanical Nomenclature – ICBN (International code of Botanical Nomenclature) Rules and Codes of ICBN, Binomial and Polynomials; Systems of classification – Natural, Artificial and Phylogenetic classification.

2. Morphology as a tool for tree identification – Field characters – Branching pattern, Leaf, Fruit and Bark. Role of reproductive characters (Flower types, floral formulas and floral diagrams). Reproductive morphology of plants with reference to description and identification of reproductive parts; General form of woody trunk and deviations like buttresses, flutes, crooks, etc.

3. Morphology and description of bark of common Indian trees including types of exfoliation patterns in bark; Characteristics of blaze on bark, colour, gums, latex, Resins, Oleogum-resins including common trees yielding tannins, gums, resins and other secretory products; Methods of Floristic survey and need for botanical explorations. General study of herbarium, arboretum, Palmetum, Fruticetum, Bambusetum and Xylarium; Allelopathic interactions of forest trees; Endemic, Rare, Endangered, Threatened and Exotic trees of India.

References

- Mishra, R. Ecology Work Book. Oxford and IBH Publishing Co, Calcutta.
- Odum, E.P. 1983. Basic Ecology. Saunders College Publishing, Holt Saunders, Japan
- Lal J. B. Forest Ecology. Natraj Publishers, Dehra Dun
- Misra KC. Manual of Plant Ecology. Oxford & IBH Pub Co. New Delhi.
- Michael P. Ecological Methods for Field and Laboratory Investigations. Tata McGraw-Hill Pub.Co. New Delhi
- Frankel, O.H., Brown, A.H.D., Burdon, J.J. 1995. The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge.
- Sagwal, S.S. 1995. Forest Ecology of India. Pioneer Publishers, India.
- Jeffrey, C. 1982. An Introduction to plant taxonomy. Allied publishers.
- Henry, A. N. and Chandrabose, M. 1980. An Aid to the International Code of Botanical Nomenclature. Today and Tomorrow printers and publishers.
- Johri, R. M and Snehlata. 2005. Taxonomy- 1 (Systematics and Morphology). Sonali Publications.

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UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)**

**FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-VI Theory syllabus
Paper – VI (A): Forest Protection
(DSE – 2: ELECTIVE)**

Theory: 4 Hours/Week; Credits-4, Marks: 100 (Internal: 20; External: 80)

Unit - I: Forest Protection and Injuries

1. Forest Protection: Introduction - need of forest protection. Factors responsible for degradation of forests. Introduction - types of protective measures - preventive and remedial, history of forest protection in India, Rights: kinds and categories, Fences and its types, Forest boundaries – kinds, maintenance and improvements. Forest offences - classification - damage - misappropriation - offences against the forest control - offences endangering forest - acts preparatory to forest offences.

2. Injuries to forest:

i. Injuries caused by human beings: Deforestation, encroachment, shifting cultivation, illicit felling (Enforcement: Beat systems, DRs & Premises, Forest CPs, Flying Squads, Van Thannas), mining, faulty management, Overexploitation of forest resources (flowers and fruits, fodder and fuel) Indirect and direct measures to control the damages

ii. Injuries caused by climatic elements: Solar radiation or insolation (drought, bark scorching, Heat crack), Heavy rain, Hail, Wind, Snow - Factors affecting snow effects, Frost (Radiation frost, Pool frost, Advective frost), Factors affecting frost resistance, Protection measures against climatic elements.

iii. Injuries caused by animals: domestic and wild animals: Grazing – Principles, pattern, damage, plan (Continuous, Unitary, Mixed and Deferred grazing), regulation of grazing: fencing i.e. stone wall, barbed wire, social fencing, Cattle proof trench, Advantages and disadvantages of forest grazing- rotational and controlled grazing.

iv. Injuries caused by plants: Excess of favoured plants, Unwanted plants (weeds, Parasites and epiphytes, Climbers), alien invasive plants

3. Forest fire – Causes (human, environmental), classification – based on general, position of fuel, cause, Fuel (ground, surface, aerial), combustion, fire behavior, consequences, control burning, Fire extinguishment, effect on vegetation, fauna, soil properties, society, management and control, purpose and formation of firebreaks, fire-line classification. Detection of forest fire, Fire combat operations, watch towers, fire watchers, Post-suppression operations, fire occurrence and damage reports, use of firefighting equipment - counter firing, dealing fire offences, Legal provisions in dealing fire offences.

Unit – II: Forest Injuries and Management

1. Injuries caused by pest and diseases: Classification of forest pests: types of damages and symptoms; factors for outbreak of pests. Adverse functions of insects. Major pests – Cutworms, White grubs, Termites, Defoliators, Sucking pests, Minor pests – Cricket, Grasshoppers. Non insect pests – Nematodes, Rodents. Nature of damage and management of forest seeds, forest nursery and standing trees of timber yielding species of natural forest and Plantation forest species, freshly felled trees, finished timber. Principles and techniques of Integrated Insect Pest Management - mechanical, physical, silvicultural, legal, biological and chemical.

2. Nursery diseases and it's management: seed diseases and control measures, seedling diseases and control measures. Seedling diseases - Damping off, Leaf spot, Leaf blight, Leaf web blight, Powdery mildew, Seedling wilt, Leaf rust, Root rot and Collar rot, Foot rot, Little leaf disease, Canker disease, Disease management strategies,

3. Susceptibility of damage to forest by pollution, nature of damage, prevention and control measures by chemical and biological control. Role of forest in carbon sequestration, carbon management, carbon foot print and carbon credit.

UNIT-III: Forest Pathology

1. 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 phanerogams. Important characters of ascomycetes and basidiomycetes. Important orders and families of Hymenomycetes with a special reference to Aphyllophorales 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

2. Distribution, economic importance, symptoms, etiology and management of diseases of important forest species like Diseases of some economic important forest species and their control measures- Teak, Sal, Shisham, Sandalwood, Eucalyptus. Diseases caused by phanerogamic plant parasite like stem parasites - cuscuta, loranthus, dendrophthoe. Root parasite – striga, orabanche. Forest disease management – Definition, scope and principles. 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.

3. 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. Wood water relationship – shrinkage, swelling, movement, fibre saturation, equilibrium moisture content. Biodegradation of wood in use.

Unit – IV: Forest extension

1. 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.

2. Forests in rural development, forest societies, interactions between forests and people, importance of forests in traditional farming systems, livestock economy and forests, social and cultural factors of forest management, man in ecosystem in relation to ecophilosophy, Forest and employment generation.

3. Afforestation programmes and forest conflicts, wildlife and human conflicts, People's movement in forest conservation, Gender dimension of forest management, Pastoralists and their dependence on forests, Forest laws/policies and their effect on people, Forestry extension.

References

- Bakshi, B.K. Forest Pathology. 1976. Principles and Practices in Forestry. Controller of Publications, New Delhi.
- Khanna, L.S. 1984. Forest Protection, Khanna Bandhu, Dehra Dun.
- Eaton RA and Hale MDC. 1993. Wood: Decay, Pests and Protection. Chapman and Hall.
- Findlay WPK. 1985. Preservation of Timber in the Tropics. MartinusNijhoff
- FAO Wood Preservation Manual. 1986. (FAO Forestry Paper No. 76).
- Richardson BA. 1993. Wood Preservation. E and FN SPON.
- Franze F.P Kollman and Wilfred A Coles. Principles of wood science and Technology Vol 1 & II Springer Verlag, Berlin.
- Barry A Rishardson . Wood preservation. Construction press London
- Metha and Thribhuvan. Hand book of forest utilisation. Periodical experts Book agency, Vivek vihar, New Delhi

TELANGANA UNIVERSITY, NIZAMABAD –TELANGANA
UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-VI Practical syllabus
Paper – VI (A): Forest Protection
(DSE – 2: ELECTIVE)

1. Collection, observation and prevention of diseased specimen and pathogenic structures.
 - i. Morphological characters of bacteria.
 - ii. Morphological characters of fungi.
 - iii. Morphological characters of viruses.
 - iv. Phytoplasma.
2. Preparation of culture media, isolation, sub culturing pathogens. Methods of inoculation and proving pathogenicity.
3. Symptoms, signs and diagnosis of tree diseases.
4. Symptoms, aetiology and control of diseases of important tree species like teak, Sal, sandalwood, shisham and eucalyptus.
5. Visit to nurseries and plantation for pathological studies
6. Tour monograph of visited pathological areas

PRACTICAL QUESTION BANK

1. Collection, observation and prevention of diseased specimen and pathogenic structures.
2. Preparation of culture media, isolation, sub-culturing pathogens. Methods of inoculation and proving pathogenicity.
3. Symptoms, signs and diagnosis of tree diseases.
4. Symptoms, aetiology and control of diseases of important tree species like teak, Sal, sandalwood, shisham and eucalyptus.
5. Visit to nurseries and plantation for pathological studies.
6. Tour monograph of visited pathological areas.
7. Record

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-VI Theory syllabus
Paper – VI (B): Forest Legislation
(DSE – 2: ELECTIVE)

Unit-I: Forest Legislation – 1

1. Forest Policy - definition, necessity, and scope, legal and institutional approaches to forest management. National Environmental Policy 2006; National Eco tourism Policy. National Forest policy – Relevance and scope.
2. Indian forest policies of 1894, 1952 and 1980, 1988 people's involvement (joint forest management, involvement of women).
3. Forest products, sustainable forest management, industrialization policies.

Unit-II: Forest Legislation – 2

1. Forest Laws - necessity, general principles, Objects of special forest law. Indian forest act 1927- Telangana state forest acts and rules.
2. Forest conservation act 1980, wildlife protection act 1972 and their amendments.
3. Application of Indian penal code to forestry. Scope and objectives of forest inventories.

Unit – III: Forest Laws

1. General principles of criminal law; Indian Penal Code, criminal procedure code; Indian evidence act applied to forestry matters. Forest laws; Indian Forest Act –1927 with recent amendments; Forest Conservation Act 1980 and Rules, Important Forest Rules and Guidelines.
2. Wildlife Protection Act 1972 with recent amendments, Biodiversity Act 2002, Plant Varieties Protection and Farmer's Rights Act 2001, The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006; Case Law.
3. Brief description about other major forest policies & laws of regional, national and international significance. Traditional land and forest management procedures and customary laws, Intellectual Property Right and bioresource patenting. Important case studies and landmark judgments. National Green Tribunal.

Unit - IV: Environmental Policy and Legislation

1. Environmental (protection) act 1986. National environmental policy 2006.
2. Water (prevention and control of pollution act) 1974. Water (prevention and control of pollution act) cess act 1977. Air (prevention and control of pollution act) 1981.
3. Municipal solid waste (management and handling) rules 2000. Biomedical waste (management and handling) rules 1998. Hazardous material (management and handling and trans-boundary movement) rules 2008.

Reference Books

- Forest policy and law by S.S. Negi.
Hand book of forestry by A.N. Chaturvedi.
Environmental studies by anubha Kaushik.
Forest policy and law by L.S. Kaushik.
Manual of law for forest officers by B.J. Shetty.
Ecology and environment by P.D. Sharma.

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UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-VI Practical syllabus
Paper – VI (B): Forest Legislation
(DSE – 2: ELECTIVE)

1. Study of various records and forms maintained in the office of the RFO with regard to management of forest under their control.
2. Study of procedure for seizure of forest property.
3. Visit to forest department and courts to observe penalty procedures.
4. Preparation of first information report and enactment report.
5. Tour management of visited forest department and legal procedures of court.

Practical Question Bank

(50 marks)

1. Study of various records and forms maintained in the office of the RFO with regard to management of forest under their control
2. Study of procedure for seizure of forest property.
3. Visit to forest department and courts to observe penalty procedures.
4. Preparation of first information report and enactment report.
5. Tour report of visited forest department and legal procedures of court.
6. Record

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UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)
FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Semester-VI Theory syllabus
Paper – VI (C): Forest Soils & its Conservation
(DSE – 2: ELECTIVE)

Unit – I: Introduction to forest soils

1. Composition of earth's crust, soil as a natural body-major components by volume-pedology rocks-types- Igneous-sedimentary and metamorphic-classification-soil forming minerals definition-classification-silicates, oxides, carbonates, sulphides, phosphates-occurrence.
2. Weathering of rocks and minerals-weathering factors-physical-chemical-biological agents involved, weathering indices-factors of soil formation, land forms-parent material-climate organism-relief-time-soil forming processes-eluviations and illuviation-formation of various soils.
3. Problem soils: salted soils, permeable, flooded, sandy soils properties. Physical parameters texture-definition-methods of textural analysis-Stock's law-assumption-limitations textural classes-use of textural triangle, absolute specific gravity-definition-apparent specific gravity/bulk density-factors influencing-field bulk density. Relation between BD. PD-Practical Problems.

Unit – II: Soil Characteristics

1. Pore space-definition-factors affecting capillary and non-capillary porosity-soil colour-definition-its significance-colour variable-hue, value, chroma, Munsell colour chart factors influencing-parent material-soil moisture-organic matter
2. Soil structure-definition classification-clay prism like structure-factors influencing genesis of soil structure, soil consistency, plasticity-Atterberg's constants.
3. Soil air-air capacity-composition-factors influencing-amount of air space-soil air renewal, soil temperature-sources and distribution of heat-factors influencing-measurement, chemical properties-soil colloids-organic-humus inorganic-secondary silicate clay, hydrous oxides.

Unit – III: Soil measurements and Conservation

1. Soil organic matter decomposition-pH nutrient availability-soil buffering capacity, soil water-forms-hygroscopic, capillary and gravitational-soil moisture constants-hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity. Energy concepts-pF scale measurement-gravimetric-electric and tensiometer methods-pressure plate and pressure membrane apparatus-Neutron probe-soil water movement-saturated and unsaturated infiltration and percolation.
2. Soil survey – classification-aerial photography-satellite-their interpretation, soil orders-land capability-classification, soils of different eco-systems and their properties; water quality parameters and assessment.
3. Soil Erosion – Causes, accumulation of toxic salts, water logging, normal and accelerated erosion, agencies (wind, water, gravity, glacial), stages of erosion by water, factors effecting water erosion. Soil conservation and reclamation in forest areas, waste lands, erosion control.

Unit – IV: Soil Biology and Fertility

1. 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.
2. 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.

3. 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 phosphorus, 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.

Suggested reading:

Biswas, T. D. and Mukherjee, S. K. 2001. Test Book of Soil Science (2nd Edition), McGraw Hill Education (India) Private Limited, New Delhi.

Brady, N. C. and Weil, R. R. 2010. Elements of the Nature and Properties of Soils (3rd Edition.), Pearson Education, New Delhi

Brady, N. C. and Weil, R. R. 2010. The Nature and Properties of Soils (14th Edition), Pearson Education, New Delhi

Foth, H.D. 1991. Fundamentals of Soil Science (8th Edition), John Wiley & Sons, New Delhi.

Das, D .K. 2011. Introductory Soil Science (3rd Edition), Kalyani publisher, Ludhiana (India).

Khan, T. O. 2013 Forest Soils: Properties and Management, Springer International Publishing, Switzerland

ISSS, 2002. Fundamentals of Soil Science. Indian Society of Soil Science, IARI, New Delhi. Pritchett and Fisher RF 1987. Properties and Management of Forest Soils. John Wiley, New York.

Gupta, P.K. 2009. Soil, Plant, Water and Fertilizer Analysis (2nd Edition), AGROBIOS, Jodhpur (India).

Jaiswal, P.C. 2006. Soil, Plant and Water Analysis (2nd Edition), Kalyani Publishers, Ludhiana.

Jackson, M. L. 2012. Soil Chemical Analysis: Advanced Course, Scientific Publisher

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UNDERGRADUATE COURSES (UNDER CBCS 2023-2024 ONWARDS)
FACULTY OF SCIENCE**

**B.Sc. (CBCS) Forestry-III year
Semester-VI Practical syllabus**

Paper – VI (C): Forest Soils & its Conservation

(DSE – 2: ELECTIVE)

1. Identification of rocks and minerals
2. Collection and preparation of soil samples
3. Soil analyses for moisture, colour, bulk density, organic matter, pH, EC
4. Textural analysis by hydrometer method
5. Study of soil profile I & II
6. Practical introduction to Tensiometer, pressure plate and neutron probe
7. Study of forest soil profile
8. Determination of C.E.C. and exchangeable cations
9. Determination of soluble cations (Ca, Mg, Na, K)
10. Determination of soluble anions (HCO_3^- , CO_3^- , Cl^- , SO_4^-)
11. Determination of available N, P & K contents of soil
12. Study of decomposition of forest litter by CO_2 – evolution method
13. Estimation of nitrification rate in soil
14. Preparation and inoculation techniques for mycorrhizae and biofertilizers.
15. Excursion tour for identification of rocks and minerals and profile studies

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FACULTY OF SCIENCE
B.Sc. (CBCS) Forestry-III year
Project / Dissertation

Theory: 4 Hours/Week; Credits-4, Marks: 100

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analysing /exploring a real life situation / difficult problem. The Project/Dissertation work will be of 4 credits. Work should be given in lieu of a discipline specific elective paper, with a view to develop creative thinking, team spirit and skill, a project work at preliminary level will be assigned to students, in groups.

Project report in the form of dissertation is prepared and submitted by the students. It will be evaluated by the External and Internal Examiners. Head of the Department will chair the evaluation panel and proceedings of viva voce. It carries a maximum of 50 marks.