

Syllabus
For
Four Year Under-Graduate Course
In
Forestry

**[New Curriculum and Credit Framework for Undergraduate Programmes]
Following NEP 2020**

With effect from the Academic Session 2024-2025



BANKURA UNIVERSITY

BANKURA, WEST BENGAL

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Introduction

In line with NEP-2020 and the new Curriculum and Credit Framework for Undergraduate Programmes (CCFUD), the undergraduate Forestry syllabus has been drafted to align with UGC guidelines while offering students the flexibility to shape their educational journey. The revised syllabus is designed to provide a well-rounded understanding of Forestry, blending core concepts with practical techniques, and allowing individual universities to adapt the content according to their specific resources and expertise.

The framework includes a flexible choice-based credit system and emphasizes a multidisciplinary approach, enabling students to tailor their studies to their interests and career goals. This new structure not only supports a broad and adaptable curriculum but also ensures that students gain a robust foundation in both theoretical and practical aspects of Forestry.

The syllabus incorporates contemporary techniques and emerging trends in the field, ensuring that students are well-prepared for current and future challenges. It is designed to equip graduates with essential skills for immediate employment, thereby enhancing job prospects without necessarily requiring further academic pursuits.

Recognizing the diversity in institutional resources and student needs, the syllabus accommodates variations in infrastructure and faculty expertise. It also integrates opportunities for research and internships, providing students with valuable hands-on experience and exposure to real-world applications in Forestry.

A. Program Outcomes:

1. To impart students with practical knowledge and to assist them in becoming well-known forestry professionals.
2. To impart students with awareness for conserving and managing forest resources, as well as protecting wildlife.
3. To develop both quantitative and qualitative methods to analyse resources and solve problems.

4. To develop the design to provide students with the most up-to-date equipment and technology used in the field of forestry.
5. To develop consciousness among students for managing forest resources, incorporate knowledge of fundamental biology, physical science, forest and wildlife ecology, and social science.
6. To develop consciousness among students for information and methods from the fields of geomatics, silviculture, economics, operations, bioproducts, and policy to design and assess alternative approaches for managing forest resources.
7. To develop appropriate concepts, models, and efficient approaches to create and assess forest resource plans that take into account numerous conflicting objectives, from woodlots to landscapes.
8. It will help to establish bonding with forest - dependent community. Thus it will help in community development.

B. Program Specific Outcomes:

1. To impart knowledge about forestry techniques from antiquity to the present.
2. To disseminate comprehensive practical knowledge of technique of growing forest trees.
3. To provide thorough knowledge about agricultural related industries.
4. To develop knowledge consciousness for geomatics, silviculture, economics, bioproducts, and policy to design and assess alternative approaches for managing forest resources.
5. Detailed knowledge about forest policies and management of forests.

Course Structure- 2024-25

Semester-Wise courses in Four Years B.Sc.(Honours) in Forestry

Semester I (20 Credit Hours)

Sl. No.	Course Code	Course	Credit		Marks			Total Marks	Teaching Hours/Week		
			Theory	Practical	End Semester Exam		Internal Marks		Lec.	Tu.	Pr.
					Theory	Practical					
1	S/FST/101/MJC-1	Introduction to Forestry and Agroforestry	3	1	25	15	10	50	3	NA	2
2	S/FST/102/MN-1	Introduction to Forestry (For students of other discipline)	3	1	25	15	10	50	3	NA	2
3	S/FST/103/MD-1	Apiculture (For students of other discipline)	1	2	25	15	10	50	1	NA	4
4	S/FST/104/SEC-1	Tree Seed, Nursery and Plantation Management	2	1	25	15	10	50	2	NA	2
5	ACS/105/AEC-1	Compulsory English: Literature and Communication	2	0	40	0	10	50	2	NA	NA
6	ACS/106/VAC-1	Environmental Studies	4	0	40	0	10	50	4	NA	NA
Total					180	60	60	300	15	0	10

Semester II (20 Credit Hours)

Sl. No.	Course Code	Course	Credit		Marks			Total Marks	Teaching Hours/Week		
			Theory	Practical	End Semester Exam		Internal Marks		Lec.	Tu.	Pr.
					Theory	Practical					
1	S/FST/201/MJC-2	Silviculture	3	1	25	15	10	50	3	NA	2
2	S/FST/202/MN-2	Forest Silviculture and Management (For students of other discipline)	3	1	25	15	10	50	3	NA	2
3	S/FST/203/MD-2	Forest Seed technology and Nursery Management (For students of other discipline)	2	1	25	15	10	50	2	NA	2
4	S/FST/204/SEC-2	Forest Soil, Nutrient and Degraded Land Management	2	1	25	15	10	50	2	NA	2
5	ACS/205/AEC-2	MIL-1 (Santali or Sanskrit or Bengali)	2	0	40	0	10	50	2	NA	NA
6	ACS/106/VAC-2	Any one of the following : A: Health and Wellness, B: Understanding India: Indian Philosophical Traditions and Value, C: Basics of Indian Constitution, D: Arts and Crafts of Bengal Systems, E:Historical Tourism in West Bengal	4	0	40	0	10	50	4	NA	NA
	ACS/107/INT-1	Summer Internship (Compulsory for 1 Year Certificate course)									
			Total		180	60	60	300	16	0	8

(MJC-Major Course, MN=Minor, MD= Multi Disciplinary, SEC= Skill Enhancement Course, AEC= Ability Enhancement Course, VAC= Value Added Course, INT= Internship, RPD=Research Project/Dissertation)

Summer Internship (Compulsory for 1 Year Certificate course)

Theory:-1Credit =1hour/Week, Practical:-1Credit =2hours/Week

****Honours with Research Students Will Opt Any One Course from
Available Four (4) Courses in Major in VIII Semester**

UG Honours Total Credit	MJC=24x4=96 MN=8x4=32 MD=3x3=9 SEC=3x3=9 AEC=4x2=8 VAC=2x4=8 INT=1x2=2	164
4 Year Honours with Research Total Credit	MJC=21x4=84 MN=8x4=32 MD=3x3=9 SEC=3x3=9 AEC=4x2=8 VAC=2x4=8 INT=1x2=2 RPD=1x12=12	164

Note: Forestry Syllabus (NEP-2020) under new curriculum and credit framework are prepared at par with the other B. Sc. (Major/Minor/ Honours) syllabus of Bankura University but there are some uniqueness in forestry.

1. The students who opt for Forestry (Major) will not be able to change **Major and Minor** in the forthcoming semester.
2. The question pattern is different from other B. Sc. Subject. The patterns and number of the questions are enclosed herewith.
3. There is a compulsory internship & District/State forest visit in the specific semester.

Distribution of Marks: For a course of 50 marks, 10 marks allotted for Internal Assessment and 40 marks for End Semester Examination (MJC-Major Course, MN=Minor, MD= Multi Disciplinary, SEC= Skill Enhancement Course)

Examination:

Question pattern: End-Semester Examination				
Sl. No	Questions to be answered	Out of	Marks of each question	Total Marks
For 40 Marks				
1	05	10	1	5×1 = 5
2	05	10	2	5×2 = 10
3	05	10	5	5×5 = 25
For 25 Marks				
1	5	08	1	5×1 = 5
2	5	08	2	5×2 = 10
3	2	05	5	2×5 = 10

Practical Exam Marks Pattern for Credit Course

For 15 Marks

Exam/ Hand Practice/ Laboratory work/Field Work/ Experiment etc.	Note Book/ Record	Viva-Voce	Total
5	5	5	15

For 50 Marks

Internship/Project or Dissertation planning and Report writing/ Study Tour Report etc.	Regularity	Presentation	Viva-Voce	Total
20	10	15	5	50

1. S/FST/101/MJC-1: Introduction to Forestry and Agroforestry (3+1)

Objective	To gain knowledge about India's & world's forest type and their vegetation. To learn about the different types of agroforestry system. To learn about various practices of agroforestry in different agro-climatic zone of India. To learn about the socio economic analysis of Agroforestry. To contribution of forest industry, other forest-based enterprises and forest ecosystem services to social, economic and environmental development.
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Theory	Topic	Lectures /Hours
Unit I	Forests and Forestry-definitions, role, benefits - direct and indirect. History of Forestry - divisions and interrelationships. Classification of forests on different basis- Age, Origin, Composition, Legal, Management, Growing Stock etc.. Forest type of India. Introduction to world forests - geographical distribution and their classification, factors influencing global forests distribution - productivity and increment of world forests. National and international organizations in forestry.	15
Unit II	Definition and scope of Agroforestry. Social, ecological, and economic benefit of agroforestry. History of agroforestry. Components of Agroforestry- Provisioning and regulator services of agroforestry. Classification of agroforestry systems. Major Agroforestry practices in different agro-ecological zones of India.	10
Unit III	Tree-crop interaction in agroforestry – Definition, kind of interaction – Positive & Negative interactions, Aboveground & belowground interactions- Manipulation of density, space, crown and roots.	10
Unit IV	Agroforestry practices for wasteland reclamation. Non-wood forest products based agroforestry – Soil fertility improvement and water conservation through agroforestry. Socio-economic analysis of various agroforestry systems. National Agroforestry Policy 2014. National and International organizations in Agroforestry.	10
Practical	Field visit in different forest sites. Identification of tree/shrub species. Identification of instruments used in forestry. Study the desirable characteristics of trees/shrubs/grasses for various agroforestry. Assessment of standing stock of tree species in various agroforestry systems. Survey of agroforestry practices in local/adjoining areas. Field observations to characterize the structural, functional and economic attributes of the agroforestry systems and practices. Diagnosis and Design of agroforestry. Assessment of productivity of tree crop combinations. Studying resource partitioning in agroforestry systems - water, light and nutrients.	30

Outcome	Knowledge about various types of forests and its vegetation of India's and world.
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	<p>The student will gain knowledge about the various concepts and developments in the field of Forestry.</p> <p>Knowledge of agroforestry and its importance in today scenario.</p> <p>Knowledge of agroforestry and its classification.</p> <p>Knowledge of new research methodology of agroforestry.</p>
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Suggested Readings

- Khanna, L.S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi, 473p.
- Mather, A.S. 1990. Global forest resources. Belhaven, London
- Beazley, M. 1981. The International Book of Forest. Mitchell Beazly Publishers, London.
- Champion, H, G and Seth, S.K. 1968. Forest types of India, a revised survey of forest types of India, GOI Press, New Delhi, 404p.
- Grebner, D.L., Bettinger, P and Siry, J.P. 2012. Introduction to Forestry and Natural Resources.
- Persson, R. 1992. World forest resources. Periodical experts, New Delhi.
- Westoby, J. 1991. Introduction to World Forestry. Wiley, 240p.
- Kumar, B.M. and Nair, P.K.R (eds). 2011. Carbon Sequestration Potential of Agroforestry Systems: Opportunities and challenges. Advances in Agroforestry 8. Springer Science, The Netherlands: 307p
- Nair, P.K.R, Rao MR, and Buck, L.E (eds), 2004. New Vistas in Agroforestry: A Compendium for the 1st World Congress of Agroforestry, Kluwer, Dordrecht, The Netherlands.
- Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Huxley, P.A. 1983 (ed). Plant Research and Agroforestry, ICRAF, Nairobi, Kenya.
- Nair, P.K.R. Agroforestry Systems in the Tropics. Springer. 680p.
- Nair, P.K.R., Kumar, B.M. and Vimala D. N. 2009. Agroforestry as a strategy for carbon sequestration. J. Plant Nutr. Soil Sci. 172: 10-23.
- Pathak P.S. and Ram Newaj (eds.) 2003. Agroforestry: Potentials and Opportunities. Agrobios, Jodhpur.

2. S/FST/102/MN-1: Introduction to Forestry(3+1) (For students of other discipline)

Objective	To gain knowledge about India's & world forest and their vegetation. To learn about the classification and types of forest. To learn about different tool and technique used in tree and stand measurements. To learn about the socio economic analysis of Agroforestry.
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Theory	Topic	Lectures
Unit I	Introduction and definition of forestry; Forest and plantation; Concept of forestry education; Brief history of forestry; Branches of forestry; Legal classification of forests: Reserved forest, Protected forest, Unclassified forest, village forest and community forest (van panchayat).	10
Unit II	Forest area and forest cover in the state, country and world; Category of forest on the basis of origin: Primary forest and secondary forest; Forest acts and policies; Importance of forests for community, environment, climate change and sustainable development.	10
Unit III	Introduction and definitions of forest mensuration; Principles of tree measurement: Height, diameter, circumference, basal area and volume; Measuring instruments in forestry: Christian's hypsometer, tree calliper, Ravi multimeter, Abney's level, Haga altimeter, meter tape, wedge prism, weighing machine and Pressler's increment borer etc.	15
Unit IV	Basic principles of forest management; Introduction, definition and scope of forest management; Participatory forest management and joint forest management (JFM). Principles of sustainable forest management. Working plain.	10
Practical	Field visit in different forest sites. Identification of tree species and their local and botanical name. Introduction about instruments used in forestry (Christian's Hypsometer, tree calliper, Ravi multimeter, Abney's level, Haga altimeter, meter tape, wedge prism, weighing machine, Pressler's increment borer, Swedish bark gauge, seed germinator, oven, balance etc.). Measurement of tree height, diameter, basal area, circumference.	30

Outcome	The student will gain knowledge about the various concepts and developments in the field of Forestry. Knowledge about various types of forests and its vegetation of India's and world. The students will gain knowledge on improving food security and livelihoods
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	<p>The students will gain knowledge on integrating forests and other land uses.</p> <p>The students will gain knowledge on tree measurements for assessing the outturn of individual as well as group of trees.</p>
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Suggested Reading

- Khanna, L.S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi, 473p.
- Mather, A.S. 1990. Global forest resources. Belhaven, London Beazley, M. 1981. The International Book of Forest. Mitchell Beazly Publishers, London.
- Champion, H, G and Seth, S.K. 1968. Forest types of India, a revised survey of forest types of India, GOI Press, New Delhi, 404p.
- Balakathiresan, S (1986). Essentials of Forest Management, Nataraj Publishers, Dehradun. Bhatta charya P., Kandy A.K. and Krishna Kumar (2008). Joint Forest Management in India, Aavishkar Publisher, Jaipur.
- Desai, V.(1991). Forest Management in India–Issues and Problems. Himalaya Pub. House, Bombay.
- Edmunds, Dand Wollen berg, E(2003). Essentials of Forest Management, Natraj Publishers, Dehradun.
- National Working Plan Code(2014). Mo EF, New Delhi. Ramprakash, (1986). Forest Management, IBD, Dehradun.
- Recknagel, Aand Bentley.J. (1988). Forest Management. IBD, Dehradun.
- Trivedi, P, Rand Sudarshan, K,N. (1996). Forest Management. Discovery publications, New Delhi.
- Dutta, R. and Yadav, B. (2012). Supreme Court on Forest Conservation. Universal Law Publishing Co., New Delhi, India
- Joy, P. P. (2012). Set up your criminal practice. Swamy Law House, Ernakulam
- Shetty, B. J. (1985). A Manual of Law for Forest Officers, Sharda Press, Mangalore
- Takwani, C. K. T and Thakker, M. C. (2012). Takwani Criminal Procedure. Lexis Nexis Butterwarths Wadhwa, Nagpur
- Varghese, M. I. (2012). Treatise on Forest Laws of Kerala. Swamy Law house, Ernakulam.
- Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun. 364 pp.
- Forest mensuration: A Handbook for Practitioners. 2006. Forestry Commission Publications. 330 pp.
- Husch, B., Beers, T.W. and Kershaw, J. J.A. 2002. Forest Mensuration (4th

edition). John Wiley & Sons, Nature. 456 pp.

- Laar, V. A. and Akca, A. 2007. Forest Mensuration. Managing Forest Ecosystems. Vol.13.
- Springer.384pp.
- Manikandan, K. and Prabhu, S. 2012. Indian Forestry. Jain Brothers. New Delhi. 590 pp.
- West, P.W. 2009. Tree and Forest Measurement (2nd edition). Springer. 192pp.

3. S/FST/103/MD-1: Apiculture (1+2) (For students of other discipline)

Objective	Acquiring knowledge of bee biology Practical skills in hive management and honey production, Understanding the role of bees in pollination, Learning safety protocols during beekeeping, Exploring business opportunities through beekeeping
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Theory	Topic	Lectures /Hours
Unit I	History of bee keeping, Species diversity of honey bees, Pollination support through beekeeping -Role of honeybees in ecosystem, Bee hives and peculiarities, Capturing of bee colonies, Bee keeping equipment's. Biology and social life of honey bees: Morphology and identification of bees, life cycle. Nesting pattern of bees, Bee sting, bee venom, venom gland, Architectural design of bee hives, types of cells.	5
Unit II	Basic operational principles of bee colonies: Selection of location, Up keeping of bee colonies, Off seasonal management of bee colonies, Growth period management, Honey flow-seasonal management, Diseases and parasites of honey bees-control measures.	5
Unit III	Honey and its ingredients: Composition of honey, conversion of nectar to honey, Medical value of honey, special properties and uses of honey, processing and value, addition of honey, Bee wax and uses, extraction, purification, processing and value addition of bee wax, Bee pollen and bee venom - uses. Marketing aspects of bee products, Role of Govt and Non-Govt agencies in promoting apiculture in West Bengal, Present status and future scope of apiculture as a small scale industry in West Bengal, and India.	5
Practical	Identification of different casts in honeybees-Queen, drones and workers, Structure of honey comb-different type of cells for queen, drones and workers, Morphological peculiarities of worker bees-Honey and pollen storage structures, Familiarize bee keeping instruments and bee hives, Familiarization with bee enemies and diseases and their control, Handling of bee colonies and manipulation for honey production.	60

Outcome	Attain practical skill in keeping the bee hive and maintain bee colonies Understand the composition and applications of bee products Describe the market value of bee products Identify various products from honey bees Understand the biology, morphology, species composition and social life of honey bees Students acquire hands on knowledge on bee keeping.
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Suggested Reading

- Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, Illinois.
- Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication, New Delhi.
- Singh, S. (1971) Beekeeping in India, ICAR publication.
- Gupta, J.K., Sharma, H K and Thakur, R K. 2009. Practical Manual on Beekeeping. Department of Entomology and Apiculture, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, p 83.
- Gupta, J K. 2010.Spring management of honey bee colonies. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, school of Agriculture, New Delhi, UNIT-I, pp 5-14, p 105.
- Gupta, J K. 2010.Management in summer. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, school of Agriculture, New Delhi, UNIT-II, pp 15-25, p 105.
- Gupta, J K. 2010.Management in monsoon season. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, school of Agriculture, New Delhi, UNIT-III, pp 26-33, p 105.
- Gupta, J K. 2010.Management in autumn season. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, school of Agriculture, New Delhi, UNIT-IV, pp 34-40, p 105.
- Gupta, J K. 2010.Management in winter. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, school of Agriculture, New Delhi, UNIT-V, pp 41-50, p 105.
- Gatoria, G.S., Gupta, J. K., Thakur, R.K. and Singh, J. 2011. Mass queen bee rearing and multiplication of honey bee colonies. All India Co-ordinated project on honey bees and pollinators, ICAR, HAU, Hisar, p70.

4. S/FST/104/SEC-1 Tree Seed, Nursery and Plantation Management (2+1)

Objective	Enhanced technical knowledge and skills in tree seed and seedling management will help to reduce risks in tree planting schemes. Aspects of tree seed biology; morphology of fruit, development and maturation of seed, longevity and dormancy. The student will learn Nursery management as an important tool for the success of
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	<p>such entrepreneurships and will help nurserymen to run profitable businesses. The subject will provides guidelines for nursery establishment and describes species specific propagation techniques, pest, disease, weed, water and nutrient management and economics.</p> <p>To gain intensive knowledge of silvicultural practices for different forest plantations for obtaining higher utilizable biomass.</p>
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Theory	Topic	Lectures /Hours
Unit I	Importance of seed in present day forestry, seed and fruit development, seed dispersal. Planning of seed collection- Methods of seed collection. Seed processing- - cleaning, drying and grading.	5
Unit II	Seed storage- Storage methods- Storage containers. Seed dormancy concept- types of dormancy, treatments for breaking exogenous and endogenous dormancy. Seed testing-definition- ISTA rules. Sampling- seed weight-moisture-authenticity-seed health. Germination testing-Germination evaluation- Indirect tests of viability. Seed Act and Seed Certification.	5
Unit III	Introduction and scope of Forest nursery. Nursery establishment - site selection – planning, and layout of nursery area. Types of forest nursery, types of nursery beds, preparation of beds, fumigation. Methods of seed sowing. Plant Propagation Techniques. Study of important nursery pest sand diseases and their control measures.	5
Unit IV	Brief idea of containerized nursery technique -advantages, disadvantages- type and size of containers. Root deformations- container designs and types/root trainers and rooting media. Planting bare-root seedlings: advantages, disadvantages. Methods for field handling and planting bare-rootstock. Nursery practices for some important tree species. Target seedling concept.	5
Unit V	Plantations-definition and scope. History of plantations, Development of plantation forestry, Plantation organization and structure, Land and plantation development. Plantation planning- National and regional planning-Plantation records-Choice of species- Plantation establishment- Plantation maintenance- Nutrition in plantations- use of fertilizers- Major pest and disease in plantations- sanitation and control measures.	5
Unit VI	Industrial plantations- paper and pulp wood- match wood, plywood plantations- Plantations yielding NTFPs- Energy plantation- high density short rotation plantations- petro crops-avenue plantations- Plantations as potential carbon sinks carbon sinks- Economic factors in plantation development- social and cultural considerations.	5
Practical	Identification of tree seeds; Seed maturity tests; Physical purity analysis; Determination of seed moisture; Seed germination test; Hydrogen peroxide test; Tetrazolium test for viability etc; Seed vigour and its measurements; Methods of breaking dormancy in tree seeds; Testing membrane permeability; Study of seed	30

	<p>collection and equipments; Seed extraction; Visit to seed production area and seed orchard; Visit to seed processing unit/testing laboratory; Study of seed sampling equipments. 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 in transplant beds. Intermediate nursery management operations. Preparation of ingredient mixture. Filling of containers. Visit to tree nurseries. Study the tools and materials for plantation establishment- Visit small and large plantations- study their management and functioning- Exposure to plantation project preparation- economic evaluation and feasibility studies of plantation projects and nursery development.</p>	
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Outcome	<p>Student will gain knowledge on seed production, collection, processing and storage. Information will be departed on managing nursery operations based on seed propagation, and the main objective is to obtain good germination and provide optimum conditions for their survival and growth into strong healthy trees. To gain knowledge of propagation techniques Students acquire hands on knowledge on the plantation techniques for important forestry operations and plantation techniques. Students acquire hands on knowledge on nursery development.</p>
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Suggested Reading

- Agrawal, R.L. 1986. Seed Technology. Oxford - IBH Publishing Co. NewDelhi
- Ahuja, P.S. et al. 1989. Towards developing-Artificial Seeds by shoot and root encapsulation. In: Tissue Culture and Biotechnology of Medicinal and Aromatic Plants. CIMAP, Lucknow, India, P. 22-28.
- Bose, T.K; Mitra, S.K. and Sadhu, M.K. 1986 Propagation of tropical and sub-tropical Horticultural crops. Naya Prakash, Calcutta
- Duryea, M.L. and Landis, T. D. (eds.) 1984. Forest Nursery Manual: Production of Bareroot Seedlings. Martinus Nijhoff/ Dr. W. Junk Publishers, The Hague/Boston/Lancaster for Forest Research Laboratory, Oregon State University, Corvallis, 386 p.
- Evans, J. 1982. Plantation Forestry in the Tropics. The English Language Book Society andClaredon Press - Oxford. 472p.
- Hartmann, H.T and Kester, D.E. 1968. Plant propagation – principles and practice prentice –Hall of India Private Limited, New Delhi.
- Khullar, P. et. al. 1992. Forest Seed. ICFRE, New Forest, Dehra Dun
- Liegel, L.H. and Venator, R. 1987. A Technical Guide for Forest Nursery Management in the Carribean and Latin America. Gen. Tech. Rep. SO-67, New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest

Experiment Station. 156p.

- Napier, I. and Robbins, M. 1989. Forest Seed and Nursery Practice in Nepal. Nepal-UK Forestry Research Project, Kathmandu
- Schmidt, L. 2000. Guide to Handling Tropical and Subtropical Forest Seed. Danida
- Suzuki, K., Ishii, K., Sakurai, S. and Sasaki, S. 2006. Plantation Forestry in the Tropics. Springer Tokyo.

5. ACS/105/AEC-1: Compulsory English: Literature and Communication (2+0)

Syllabus from University pool

6. ACS/106/VAC-1: Environmental Studies (4+0)

Syllabus from University pool

Semester II (20 Credit Hours)

1. S/FST/201/MJC-2: Silviculture (3+1)

Objective	<p>To develop basic understanding on forest and factors influencing forest growth and development.</p> <p>To impart knowledge on tending operations followed in forest with preliminary information on succession in forest</p> <p>To learn about natural and artificial regeneration.</p> <p>To learn how to production superior quality timber.</p>
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Theory	Topic	Lectures /Hours
Unit I	Silviculture- objectives and scope-relation with other branches of Forestry Silvics. Site factors - climatic, edaphic, physiographic, biotic and their interactions. Trees and their distinguishing features, growth and development. Root growth-fine root/functional root production- Direct and indirect benefits- biophysical interactions- trees and buffering functions- C sequestration potential of forests.	10
Unit II	Silvicultural systems-definition, scope and classification. Systems of concentrated regeneration- systems of diffused regeneration- accessory systems- Clear felling systems- Shelter wood system - Selection system and its modifications- Coppice systems- copies with standard Culm selection system in Bamboo, Canopy lifting system in Andaman. Silvicultural systems followed in other countries.	10
Unit III	Regeneration of forests – objectives - ecology of regeneration-natural and artificial regeneration. Natural regeneration-seed production, seed dispersal, germination and establishment, requirement for natural regeneration, advance growth, coppice, and root sucker, regeneration survey, natural regeneration supplemented by artificial regeneration.	10
Unit IV	Artificial regeneration - object of artificial regeneration - advantages. Factors governing the choice of regeneration techniques. Tree planting- Sowing v/s planting different kinds of pits- tending and cultural operations- weeding- kinds of weeding- release operations- singling, cleaning-liberation cutting.	5
Unit V	Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, stand management practices pest and diseases and economic importance of the some Broad leaved, Conifers, Fast growing and MPTs of India.	10
Practical	Acquaintance with modern silvicultural tools. Visits to different forest areas/types. Study offorest composition. Field preparation- marking, alignment and stacking, pit making-planting, various tending operations- weeding, cleaning, singling, pruning, pollarding, lopping, and thinning- fertilization	30

	<p>in trees-plant protection and sanitation measures. Study the morphological description and field identification characteristics of trees, seeds and seedlings. Study the silviculture of trees in response to light, fire, drought, frost, root suckering, coppicing and pollarding, etc. Visit various problems areas and study on species suitability. Visit forest plantations and other wood lots. Study the planting density and stand management regimes for various end uses such as timber, pulpwood, plywood, cottage industries etc.</p>	
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Outcome	<p>The student will gain knowledge on basic of forestry and factors influencing forest growth and development with practical training on tending operations in forest.</p> <p>The students also gain practical and field knowledge on regeneration of forest and raising plantation with proper information on different silvicultural systems followed in Indian forest.</p> <p>The students would acquire basic knowledge on Silviculture and silviculture system of some broad leaved and conifer tree species of India</p> <p>Knowledge about the silviculture characters of species</p> <p>Knowledge about the artificial and natural regeneration of species</p> <p>Knowledge about the economic importance of species</p>
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Suggested Reading

- Hopkins, W.G. and Huner, N.P.A. (2008) Introduction to plant physiology. Wiley.
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2. S/FST/202/MN-2: Forest Silviculture and Management (3+1)

(For students of other discipline)

Objective	<p>To study the art and science of forest trees.</p> <p>To study the various types of forest, and their classification.</p> <p>To study the factors effecting the growth and establishment of forest.</p> <p>To learn about natural and artificial regeneration.</p> <p>To learn about increase production or higher volume per unit area.</p> <p>To understand the principles and concepts of forest management</p> <p>To impart knowledge on normal forest and sustainable forest management</p> <p>To know the methodology of working plan preparation</p>
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Theory	Topic	Lectures /Hours
Unit I	Silviculture- definitions objectives and scope -relation with other branches of Forestry. Site factors - climatic, edaphic, physiographic, biotic and their interactions. Trees and their distinguishing features, growth and development. Root growth- fine root/functional root production- Direct and indirect benefits- biophysical interactions- trees and buffering functions.	5
Unit II	Silvicultural systems-scope and classification. Systems of concentrated regeneration- systems of diffused regeneration- accessory systems- Clear felling systems-	15

	Shelter wood system - Selection system and its modifications- Coppice systems- coppies with standard Culm selection system in Bamboo, Canopy lifting system in Andaman. Silvicultural systems followed in other countries.	
Unit III	Regeneration of forests - objectives - ecology of regeneration- natural, and artificial regeneration. Natural regeneration-seed production, seed dispersal, germination and establishment, requirement for natural regeneration, advance growth, coppice, and root sucker, regeneration survey. Artificial regeneration - objective - advantages. Factors governing the choice of regeneration techniques. Tree planting- Sowing v/s planting different kinds of pits-tending and cultural operations- weeding.	15
Unit IV	Forest management- definition, scope, objective and principles. Sustainable forest management- definition, scope, objective, criteria and indicators- progressive yields. Rotation -definitions-types- length. Normal forest-definitions basic factors of normality. Working plan-preparations- objectives and uses. Joint forest management-concept and principles- Modern tools in forest management. Introduction to the concept of forestry as a common property resource-Forests and man- Community forest management & development. Gender dimensions in Community forest management.	10
Practical	Acquaintance with modern silvicultural tools. Visit to different forest divisions to study the various stand management aspects. Study of forest composition. Field preparation- marking, alignment and stacking, pit making-planting, various tending operations-weeding, cleaning, singling, pruning, pollarding, lopping, and thinning- fertilization in trees-plant protection and sanitation measures. Study the morphological description and field identification characteristics of trees, saplings and seedlings. Study the silviculture of trees in response to light, fire, drought, frost, root suckering, coppicing and pollarding, etc. Study forest organizational set up and forest range administration including booking of fences. Field Exercise for the estimation of actual growing stock volume. Field visit to JFM operational areas. Study the different field exercises for data collection for working plan.	30

Outcome	<p>The student will gain knowledge on basic of forestry and factors influencing forest growth and development with practical training on tending operations in forest.</p> <p>The students also gain practical and field knowledge on regeneration of forest and raising plantation with proper information on different silvicultural systems followed in Indian forest.</p> <p>The students will gain knowledge on forest management, working plan preparation and sustainable forest management concepts.</p>
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3. S/FST/203/MD-2: Forest Seed technology and Nursery Management (2+1)**(For students of other discipline)**

Objective	To impart knowledge on production, collection, processing, quality control and storage of tree seeds and its application in production and conservation of forests. To impart knowledge on nursery preparation and management.
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Theory	Topic	Lectures/ Hours
Unit I	Seed- morphology & physiology. Importance of seed in present day forestry, seed and fruit development, seed dispersal. Planning seed collection-Collection of immature fruits - Methods of seed collection. Fruit and seed handling-maintaining viability and identity- special precautions for recalcitrant seeds. Seed processing- operations prior to extraction- pre- cleaning, methods of extraction- operations after extraction- cleaning, grading and control of moisture level- factors affecting drying of orthodox seeds. Seed storage- definition-purpose, recalcitrant seeds-Harrington's rule of thumb, seed maturity- parental and annual effects. Storage condition and ageing of seeds. Storage methods-Storage containers.	10
Unit II	Seed dormancy- types of dormancy, treatments for breaking exogenous and endogenous dormancy. Seed dressing and pelleting. Seed testing-definition-ISTA rules. Sampling- seed weight- moisture- authenticity- seed health. Germination testing- germination equipment-conditions for selected species. Germination evaluation- germination testing in nursery. Indirect tests of viability. Seed Act and Seed Certification.	5
Unit III	Introduction and scope of Forest nursery. Nursery establishment - site selection – planning, and layout of nursery area. Types of forest nursery, types of nursery beds, preparation of beds, fumigation. Methods of seed sowing and mulching, seedling growth and development, pricking, weeding, hoeing, rotation, organic matter supplements and cover crops, mycorrhizae, fertilization, shading, pruning, root culturing techniques, lifting windows, grading, packaging. Storing and transportation.	10

Unit IV	Containerized nursery technique -advantages, disadvantages- root deformations- container designs and types/root trainers and rooting media. Methods for field handling and planting bare- root stock. Containerized nursery technique- Type and size of containers. Merits and demerits of containerized nursery. Root trainer techniques- Preparation of ingredient mixture. Study of important nursery pests and diseases and their control measures. Nursery practices for some important tree species. Target seedling concept.	5
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; Seed extraction; Visit to seed production area, seed orchard, seed processing unit/testing laboratory; Study of seed sampling equipments. 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. Mother beds and transplant bed preparation- Pricking and transplanting of in transplant beds. Intermediate nursery management operations. Preparation of ingredient mixture. Filling of containers. Visit to nurseries.	30

Outcome	<p>Student will gain knowledge on seed production, collection, processing and its importance for tree and forest.</p> <p>Students would acquire adequate knowledge and skill on production of nursery and clonal seedlings in trees. They will also gain knowledge on commercial tree nursery and clonal production.</p> <p>Goal of seed technology is to increase agricultural production through spread of good quality seed of high yielding varieties developed by the plant breeders.</p>
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encapsulation. In: Tissue Culture and Biotechnology of Medicinal and Aromatic Plants. CIMAP, Lucknow, India, P. 22-28.

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4. S/FST/204/SEC-2: Forest Soil, Nutrient and Degraded Land Management (2+1)

Objective	Learn the fundamental principles of the chemistry and physics of soil. To impart knowledge about the geology, rocks and soil formation. Learn the essentiality of nutrients in soil, their status and availability. Learn soil organic matter transformation and the dynamics of N and P pools in
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	soil. To develop skills on tacking different problem soils with suitable vegetation
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Theory	Topic	Lectures /Hours
Unit I	Forest soils- characteristics- distinguishing features- changes in physical and chemical properties compared to agricultural soils. Introduction to Soil Science - its significance, composition of earth's crust, soil as a natural body - major components by volume.	5
Unit II	Pedology –rocks types - soil forming. Weathering of rocks and minerals -weathering factors. Factors of soil formation. Soil forming processes. Physical and chemical properties of Soil. Elementary knowledge of soil classification – soil orders.	5
Unit III	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. Bio-fertilizers – their importance. Nitrogen fixation. Mycorrhizae: types, biology and importance. Organic matter decomposition - Factors affecting organic matter decomposition – Stages of organic matter decomposition - C: N ratio.	5
Unit IV	Degraded lands: Concept, classification, status, extent and causes of degraded lands/waste lands, different types of degraded lands–physical, chemical and biological. Soil erosion-types, causes and mechanism, their control measures. Different problematic soil(Salt affected, Acidic, water logged etc.)- causes, characteristics and reclamation, bio-drainage techniques.	5
Unit V	Afforestation and reclamation of denuded hill slopes, landslips and landslides, avalanche and cold desert, mined out, dry, rocky and murray areas. Desertification- definition, impact and causes, prevention and counter measures (shelterbelts and windbreaks).Soil pollution- types, effects and control measures through forestry techniques. National and state level programmes on degraded lands/waste land development. Role of Government agencies and NGO's in degraded lands/waste land development programme.	10
Practical	Identification of rocks and minerals; Study of soil profile; Collection and preparation of soil samples; Soil analyses- Physicochemical parameters like moisture, colour, bulk density, organic matter, pH, EC; Textural analysis, available N, P, K, Ca, Mg, S and micronutrients etc. and interpretation of their results. Identification and study of various degraded lands. Visit to nearby degraded lands (eroded site, ravine and sand dune, coastal area, waterlogged area, denuded hill slopes, land slips and landslides, avalanche and cold desert, mined out, dry, rocky and Murray areas) and afforestation programme.	30

Outcome	<p>Student will gain knowledge about the geology, pedology and soil formation process.</p> <p>This paper also gain knowledge about physicochemical property of soil and its importance for tree and forest.</p> <p>Student acquires knowledge on physicochemical and biological property of forest and cultivated soil.</p> <p>Student also gains knowledge on different type of fertilizer and their use.</p> <p>Student will gain knowledge on seed production, collection, processing and its importance for tree and forest.</p> <p>Students would acquire adequate knowledge and skill on soil test.</p> <p>The student will gain theoretical and field knowledge on rejuvenation of difficult site and problem soils with suitable tree vegetation.</p>
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5.ACS/205/AEC-2: Drawn from University Pool (2+0)

6. ACS/106/VAC-2: Drawn from University Pool (2+0)

7. ACS/107/INT-1: Summer Internship (Compulsory for 1 Year Certificate course) (0+4)

Practical	Topic
	<p>The students will have an internship or training. The internship should be preferably arranged outside of the parent institution at any assigned organisation, industry, research institution, project, or with a progressive farmer, agribusiness, related to course etc.</p> <p>After the completion of their internship, the students will have to submit a report of their learning's and also present it in the form of a seminar before nominated faculty members and other students.</p> <p>The assessment will be based on the report or assessment received from the industry or organisation, the report, and the presentation made at the university or college.</p>