



**B.Sc. FORESTRY [Eight (8) Semester] CHOISED BASED CREDIT
SYSTEM(CBCS)
SCHEME OF INSTRUCTION AND CREDITS**

**B.Sc. FORESTRY
[Eight (8) Semester]
CHOISED BASED CREDIT SYSTEM(CBCS)**

(Effective from Academic Year 2021-22)

**HNB GARHWAL UNIVERSITY
(A CENTRAL UNIVERSITY)
SRINAGAR-GARHWAL
UTTARAKHAND**

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME
OF INSTRUCTIONS AND CREDITS**

COURSE CONTENTS

Semester-wise Courses

Semester I

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC 101 T	Introduction to Forestry	2	70	30	100
2	SOA/FC 102 T	Dendrology	2	70	30	100
	SOA/FC 102 P	Dendrology	1	100	-	100
3	SOA/FC 103 T	Geology and Soils	2	70	30	100
	SOA/FC 103 P	Geology and Soils	1	100	-	100
4	SOA/FC 104 T	Plant Biochemistry	2	70	30	100
	SOA/FC 104 P	Plant Biochemistry	1	100	-	100
5	SOA/FC 105 P	Technique/field tour	2	100	-	100
Ability Enhancement Compulsory Course (AECC)						
1	SOA/FAECC101 T	Communication Skills and Personality Development	1	70	30	100
	SOA/FAECC101 P	Communication Skills and Personality Development	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE101 T	Introduction to Agronomy and Horticulture	1	70	30	100
	SOA/FE101 P	Introduction to Agronomy and Horticulture	1	100	-	100
2	SOA/FE102 T	Information and Communication Technology	1	70	30	100
	SOA/FE102 P	Information and Communication Technology	1	100	-	100
3	SOA/FE103 T	Forest Botany	1	70	30	100
	SOA/FE103P	Forest Botany	1	100	-	100

4	SOA/FE104 T	Basics Mathematics	2	70	30	100
5	SOA/FE105P	NCC-I/NSS-I*	1	-	-	-

* Non credit course

Total Credit to earn in the Semester I

Core	AECC	SEC	ELECTIVE	TOTAL
13	2	0	6	21

Note: Theory (T) and P

Semester II

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC106T	Plant Physiology	2	70	30	100
	SOA/FC106P	Plant Physiology	1	100	-	100
2	SOA/FC107T	Plant Cytology and Genetics	2	70	30	100
	SOA/FC107P	Plant Cytology and Genetics	1	100	-	100
3	SOA/FC108T	Theory and Practice of Silviculture	2	70	30	100
	SOA/FC108P	Theory and Practice of Silviculture	1	100	-	100
4	SOA/FC109T	Forest Protection	2	70	30	100
	SOA/FC109P	Forest Protection	1	100	-	100
Ability Enhancement Compulsory Course (AECC)						
1	SOA/FAECC10 2T	Statistical Methods & Experimental Designs	2	70	30	100
	SOA/FAECC10 2P	Statistical Methods & Experimental Designs	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE106T	Wood Anatomy	2	70	30	100
	SOA/FE106P	Wood Anatomy	1	100	-	100
2	SOA/FE107T	Environmental Studies and Disaster Management	2	70	30	100
	SOA/FE107P	Environmental Studies and Disaster Management	1	100	-	100

3	SOA/FE108P	NCC-II/NSS-II*	1	-	-	-
---	------------	----------------	---	---	---	---

* Non credit course

Total Credit to earn in the Semester II

Core	AECC	SEC	ELECTIVE	TOTAL
12	3	0	6	21

Semester III

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC110T	Forest Survey and Engineering	2	70	30	100
	SOA/FC110P	Forest Survey and Engineering	1	100	-	100
2	SOA/FC111T	Tree Improvement	2	70	30	100
	SOA/FC111P	Tree Improvement	1	100	-	100
3	SOA/FC112T	Principles of Agroforestry	2	70	30	100
	SOA/FC112P	Principles of Agroforestry	1	100	-	100
4	SOA/FC113T	Forest Mensuration	2	70	30	100
	SOA/FC113P	Forest Mensuration	1	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC101T	Soil Biology and Fertility	2	70	30	100
	SOA/FSEC101P	Soil Biology and Fertility	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE109T	Wildlife Biology, Ornithology & Herpetology	2	70	30	100
	SOA/FE109P	Wildlife Biology, Ornithology & Herpetology	1	100	-	100
2	SOA/FE110T	Forest Ecology and Biodiversity	2	70	30	100
	SOA/FE110P	Forest Ecology and Biodiversity	1	100	-	100
3	SOA/FE111P	NCC-III/NSS-III*	1	-	-	-

* Noncredit course

Total Credit to earn in the Semester III

Core	AECC	SEC	ELECTIVE	TOTAL
12	0	3	6	21

Note: Theory (T) and Practical (P) are linked to each other.

Semester IV

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC114T	Forest Management	2	70	30	100
	SOA/FC114P	Forest Management	1	100	-	100
2	SOA/FC115T	Silviculture of Indian Trees	2	70	30	100
	SOA/FC115P	Silviculture of Indian Trees	1	100	-	100
3	SOA/FC116T	Silviculture of Indian Trees	2	70	30	100
	SOA/FC116P	Wood Products & Utilization	1	100	-	100
4	SOA/FC117T	Ethnobotany, Medicinal and Aromatic Plants	2	70	30	100
	SOA/FC117P	Ethnobotany, Medicinal and Aromatic Plants	1	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC102T	Nursery Management and Commercial Forestry	2	70	30	100
	SOA/FSEC102P	Nursery Management and Commercial Forestry	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE112T	Tree Seed Technology	1	70	30	100
	SOA/FE112P	Tree Seed Technology	1	100	-	100
2	SOA/FE113T	Rangeland and Livestock Management	1	70	30	100
	SOA/FE113P	Rangeland and Livestock Management	1	100	-	100
3	SOA/FE114T	Forest Tribology & Anthropology	2	70	30	100
4	SOA/FE115P	Study Tour of State Forest*	1	-	-	-

* Noncredit course

Total Credit to earn in the Semester IV

Core	AECC	SEC	ELECTIVE	TOTAL
12	0	3	6	21

Semester V

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC118T	Climate Science	2	70	30	100
	SOA/FC118P	Climate Science	1	100	-	100
2	SOA/FC119T	Wood Science and Technology	2	70	30	100
	SOA/FC119P	Wood Science and Technology	1	100	-	100
3	SOA/FC120T	Logging and Ergonomics	2	70	30	100
	SOA/FC120P	Logging and Ergonomics	1	100	-	100
4	SOA/FC 121 P	Experimental Learning - I	5	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC103T	Entrepreneurship Development & Business Management	1	70	30	100
	SOA/FSEC103P	Entrepreneurship Development & Business Management	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE116T	Forest Hydrology and Watershed Management	1	70	30	100
	SOA/FE116P	Forest Hydrology and Watershed Management	1	100	-	100
2	SOA/FE117T	Forest Economics and Marketing	1	70	30	100
	SOA/FE117P	Forest Economics and Marketing	1	100	-	100
3	SOA/FE118T	Forest Extension & Community Forestry	1	70	30	100
	SOA/FE118P	Forest Extension & Community Forestry	1	100	-	100

Total Credit to earn in the Semester V

Core	AECC	SEC	ELECTIVE	TOTAL
14	0	2	6	22

Note: Theory (T) and Practical (P) are linked to each other.

Semester VI

S.No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC122T	Forest Laws, Legislation and Policies	2	70	30	100
2	SOA/FC123T	Geomatics	2	70	30	100
	SOA/FC123P	Geomatics	1	100	-	100
3	SOA/FC124T	Restoration Ecology	2	70	30	100
	SOA/FC124P	Restoration Ecology	1	100	-	100
4	SOA/FC125P	Experiential Learning-II	5	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC104T	Plantation Forestry	2	70	30	100
	SOA/FSEC104P	Plantation Forestry	1	100	-	100
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE119T	Non-Timber Forest Products, Marketing & Trade	1	70	30	100
	SOA/FE119P	Non-Timber Forest Products, Marketing & Trade	1	100	-	100
2	SOA/FE120T	Certification of Forest Products	2	70	30	100
3	SOA/FE121T	Recreation and Urban Forestry	1	70	30	100
	SOA/FE121P	Recreation and Urban Forestry	1	100	-	100

Total Credit to earn in the Semester VI

Core	AECC	SEC	ELECTIVE	TOTAL
13	0	3	6	22

Note: Theory (T) and Practical (P) are linked to each other.

VII Semester

S. No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC125T	Forest Inventory and Yield Prediction	1	70	30	100
	SOA/FC126P	Forest Inventory and Yield Prediction	1	70	30	100
2	SOA/FC126T	Forest Biotechnology	2	70	30	100
	SOA/FC127P	Forest Biotechnology	1	100	-	100
3	SOA/FC127T	Agroforestry Systems and Management	2	70	30	100
	SOA/FC128P	Agroforestry Systems and Management	1	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC105P	Industrial Placement (20 days)	4	100	-	100
2	SOA/FSEC106P	Socio-Economic Survey and Village Attachment (20 days)	4	100	-	100
3	SOA/FSEC107P	All India Tour*	3	-	-	-
Elective						
Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.						
1	SOA/FE122T	Wildlife Management	2	70	30	100
	SOA/FE122P	Wildlife Management	1	100	-	100
2	SOA/FE123T	Agriculture Informatics	2	70	30	100
	SOA/FE123P	Agriculture Informatics	1	100	-	100

*Non-credit course

Total Credit to earn in the Semester VII

Core	AECC	SEC	Elective	Total
08	0	08	06	22

VIII Semester: Student READY-Forestry Work Experience (FOWE)

S. No.	Course Code	Name of the Courses	Credits	Marks		Total
				External	Internal	
	Core Course					
1	SOA/FC129P	Forest Range Training Program (50 days)	10	100	-	100
2	SOA/FC130P	Report Writing and Presentation	2	100	-	100
Self and Social Development Course (SSDC)*						
1	SOA/FSSDC01P	Orientation (10 days)	1	100	-	100
2	SOA/FSSDC02P	Weapon Training and First Aid Training (5+3=8 days)	1	100	-	100
Skill Enhancement Course (SEC)						
1	SOA/FSEC108P	Project Work and Dissertation	10	100	-	100

Total Credit to earn in the Semester VIII

Core	AECC	SSDC	SEC	Total
12	0	02	10	24

*As per guideline of NEP-2020 Self and Social Development Course (SSDC) is compulsory for UG student. (for 02 credits and 30 hours)

SUMMARY OF CREDITS

SEMESTER	CORE	AECC	SEC	ELECTIVE	SSDC	TOTAL
I	13	02	-	06	-	21
II	12	03	-	06	-	21
III	12	-	03	06	-	21
IV	12	-	03	06	-	21
V	14	-	02	06	-	22
VI	13	-	03	06	-	22
VII	08	-	08	06	-	22
VIII	12	-	10	-	02	24
TOTAL	96	05	29	42	02	174

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM
(CBCS)**

SCHEME OF INSTRUCTIONS AND CREDITS

Details Syllabus

Semester-I

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 101 T	Introduction to Forestry	2	70	30	100

Unit I

Theory - Forests - definitions, role, benefits - direct and indirect. History of Forestry - Definitions divisions and interrelationships. Classification of forests - High forests, coppice forests, virgin forest and second growth forests, pure and mixed forests - even and uneven aged stands. Forest types of India- classification.

Unit II

Agroforestry, farm forestry, social forestry, joint forest management concepts, programmes and objectives. Important acts and policies related to Indian forests. Global warming - forestry options for mitigation and adaptation - carbon sequestration. Important events/dates related to forests and environment - themes and philosophy.

Unit III

Introduction to world forests - geographical distribution and their classification, factors influencing global forests distribution - productivity and increment of world forests. Forest resources and forestry practices in different regions of the world - Western Europe, North America, Central Africa, Australia, Central America, Russia, Japan, and China. General problems of forest development and economy.

Unit IV

Forest/wood based industries in the developed and developing countries. Trade patterns of forest based raw materials. Recent trends in forestry development in the world. National and international organizations in forestry.

Suggested Readings

- 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. Academic Press. 508p (Google eBook).
- Khanna, L.S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi, 473p.
- Mather, A.S. 1990. Global forest resources. Belhaven, London.
- Persson, R. 1992. World forest resources. Periodical experts, New Delhi.
- Westoby, J. 1991. Introduction to World Forestry. Wiley, 240p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 102 T	Dendrology	2	70	30	100

Unit I

Introduction – Importance and scope of dendrology, Principles and systems of plant classification. Detailed study of Bentham and Hooker natural system, its advantages and disadvantages. Plant Nomenclature – objectives, principles and International Code of Botanical Nomenclature.

Unit II

Role of vegetative morphology in identification of woody forest flora. Peculiarities of bole, general form of woody trunk and deviations like buttresses, flutes, etc. Morphology and description of barks of common trees. Characteristics of blaze, bark colour, exudations etc. Morphology of leaf, different types of leaves, colour of young and old leaves in some species as (regular) features of identification. Reproductive morphology of plants with reference to description and identification of reproductive parts.

Unit III

Detailed study of the families- diagnose the features-floral variations–distribution and economic importance-systematic position as per Bentham & Hooker System of classification-Magnoliaceae, Annonaceae, Clusiaceae, Dipterocarpaceae, Malvaceae, Sterculiaceae, Tiliaceae, Rutaceae, Meliaceae, Sapindaceae, Anacardiaceae, Fabaceae, Rhizophoraceae, Combretaceae, Myrtaceae, Rubiaceae, Sapotaceae, Apocyanaceae, Bignoniaceae, Lamiaceae, Lauraceae, Euphorbiaceae, Santalaceae Orchidaceae, Palmae Arecaceae and Poaceae. Taxaceae, Casuarinaceae and Pinaceae.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 102 P	Dendrology	1	100	-	100

Practical –

Morphological description of plant parts and method of collection of plants. Techniques of preparing herbarium specimens. General study of herbarium. Dissection of flowers-making sketches-construction of floral diagrams of one species of the following families: Annonaceae and Clusiaceae, Dipterocarpaceae and Malvaceae, Sterculiaceae, Tiliaceae, Rutaceae, Meliaceae, Sapindaceae Anacardiaceae, Fabaceae - Papilionaceae-Mimosaceae–Caesalpiniaceae, Rhizophoraceae, Combretaceae, Myrtaceae, Rubiaceae, Sapotaceae, Apocyanaceae, Taxaceae, Casuarinaceae Bignoniaceae, Lamiaceae, Euphorbiaceae, Taxaceae and Casuarinaceae, Orchidaceae and Poaceae, Pinaceae.

Suggested Reading

- Ashok Kumar (2001). Botany in Forestry and Environment. Kumar Media (P) Ltd. Gandhinagar, Gujarat.

- Bor N. L. (1990). Manual of Indian Forest Botany. Periodical Expert Book Agency. New Delhi.
- Brandis. D. Revised by R. D. Jakarti (2010). Indian Trees. Dehradun.
- Charles McCann. (1966). 100 Beautiful Trees of India. D. B. Taraporevala Sons & C. Pvt. Ltd. Mumbai. (Available online PDF)
- Father H. Santapau. (1966). Common Trees. (Available online PDF)
- Gurucharan Singh. (2000). Plant Systematics. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Hardin, W., Harrar, E.S., and White, F.M. (1995) Textbook of Dendrology (8th Edition). McGraw-Hill Companies, London
- Jain S. K. and R. R. Rao. (1977). Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers. New Delhi.
- Lawrence, G.H.M.(1967). Taxonomy of Vascular Plants. Oxford&IBH, New Delhi.
- Mishra. S.R.(2010). Textbook of Dendrology. Discovery Publishing House Pvt. Ltd. New Delhi.
- Naqshi. R. (1993). An Introduction to Botanical Nomenclature. Scientific Publishers. Jodhpur.
- Pandey S. N. and S. P. Mishra. (2008). Taxonomy of Angiosperms. Ane Books India, New Delhi.
- Parker. R. N. (1933). Forty Common Indian Trees and How to know them. (Available online PDF)
- Randhawa. M. S. (1957). Flowering Trees in India. Sree Saraswati Press Ltd. Kolkatta.
- Sahni. K. C. (2000). The Book of Indian Trees. Bombay Natural History Society. Mumbai.
- Tewari D. N. (1992). Tropical Forestry in India. International Book Distributors, Dehradun.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 103 T	Geology and Soils	2	70	30	100

Theory

Introduction to geology - its significance, 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. Weathering of rocks and minerals -weathering factors -physical-chemical-biological agents involved, weathering indices. Factors of soil formation- parent material, climate, organism, relief, time. Soil forming processes-eluviations and illuviation, formation of various soils. Physical parameters- texture-definition, methods of textural analysis, Stokes law, textural classes, use of textural triangle, absolute specific gravity-definition apparent specific gravity/bulk density-factors influencing-eld bulk density, relation between bulk density- particle density. Pore space-definition-factors affecting capillary and non capillary porosity- soil colour-definition-its significance - ficolour variable-hue, value, chroma, Munsell colour chart- factors influencing-parent material-soil moisture-organic matter. Soil structure-definition- classification-clay- prism like structure-factors influencing genesis of soil structure, soil consistency, plasticity-Atterberg's constants. Soil air-composition, factors influencing-amount of air space. Soil temperature-sources and distribution of heat-factors influencing-measurement. Chemical properties -soil colloids organic- humus-inorganic-secondary silicate-clay-hydrous oxides. Soil organic matter decomposition - concept of pH - soil acidity -nutrient availability- soil buffering capacity – a brief overview of saline, sodic and calcareous soils. 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. Elementary knowledge of soil classification – soil orders. Forest soils-characteristics- distinguishing features- changes in physical and chemical properties compared to agricultural soils.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 103 P	Geology and Soils	1	100	-	100

Practical –

Identification of rocks and minerals; Collection and preparation of soil samples; Soil analyses for moisture, colour, bulk density, organic matter, pH, EC; Textural analysis by hydrometer method; Study of soil profile; Study tour for identification of rocks and minerals and profile studies; Practicals on introduction to Tensiometer, pressure plate and neutron probe etc.

Suggested Reading

- Biswas, T.D. and Mukherjee, S. K. 1987. Test Book of Soil Science, Tata McGraw Hill Publishing Co., New Delhi
- Brady, N. C. 1990. Nature and Properties of Soils. 10th ed., Macmillan Publishing Co. Inc., New York
- Foth, H.D. and Turk, L. M. 1972. Fundamental of Soil Science. 5th edn. Wiley Eastern Pvt. Ltd., New Delhi
- Gupta, P,K. 2007. Soil, Plant, Water and Fertilizer Analysis. Published by AGROBIOS (India), Jodpur
- Indian society of soil science (ISSS). 2002. Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI, New Delhi
- Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd Edn. Kalyani Publishers, Ludhiyana
- Pritchett and Fisher R, F. 1987. Properties and Management of Forest Soils. John Wiley, New York.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	

SOA/FC 104 T	Plant Biochemistry	2	70	30	100
---------------------	---------------------------	----------	-----------	-----------	------------

Theory

Chemistry of carbohydrates—classification, mono, di and poly saccharides, anomerism, epimerism, mutarotation, configuration of sugars and in version. Chemistry of lipids—classification, simple lipids and phospho lipids. Fatty acids and fat content, lipids of chloroplast, membrane lipids. Chemistry of amino acids, peptides and proteins, classification, levels of protein structure. Chemistry of nucleic acids—bases, sugars, Nuclease Enzymes—classification, enzyme kinetics, enzyme inhibition, allosteric enzymes, lysozymes, coenzymes. Metabolism of carbohydrates—glycolysis, TCA cycle, HMP shunt, glyoxylic acid cycle, electron transport chain. Lipids metabolism—beta oxidation and fatty acid biosynthesis

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 104 P	Plant Biochemistry	1	100	-	100

Practical –

Preparation of solutions of different concentrations, pH and buffers. Qualitative tests for carbohydrates, Quantitative estimation of reducing sugars by DNS method, Quantitative test for total carbohydrates by Anthrone reagent, Qualitative tests for lipids, Determination of Saponification number of oils/fats, Determination of Iodine number of fatty acids, Qualitative tests for proteins/amino acids, Estimation of protein by Lowry's method, Determination of Michaelis constant of enzymes, Estimation of RNA.

Suggested Reading

- Conn, E.E. and Stumpf, P.K.(1989). Outlines of Biochemistry, Wiley Eastern Ltd., New Delhi
- Mazur, A and Harrows, B.(1971). Text book of Biochemistry. W.B. Sanders Publications, New Delhi.
- William, H.E. and Daphne, C.E.(2005). Biochemistry and Molecular Biology, Oxford University Press.
- Books in our library.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC 105 P	Technique/field tour	2	100	-	100

Student will be taken for 3 to 4 days field tour by concern class mentor and class teacher.

(Cost of tour shall be borne by the students)

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FAECC101 T	Communication Skills and Personality Development	1	70	30	100

Theory –

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences. Applied Grammar: Introduction to Word Classes. Structure of the Verb in English. Uses of Tenses. Study of Voice. Use of Conjunctions and Prepositions. Sentence Patterns in English. Spoken English: Conversations of Different Situations in Everyday Life. The Concept of Stress, Stress Shift in Words and Sentences. Words with Silent Letters and their Pronunciations. The Basic Intonation patterns.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FAECC101 P	Communication Skills and Personality Development	1	100	-	100

Practical –

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Suggested Reading

- Carroll, B.J. 1986. English for college, Macmillan India Ltd. New Delhi
- Hahn, "The Internet complete reference", TMH
- Hornby, A.S. 1975. Guide to patterns and usage in English. Oxford University, New Delhi.
- Qurik, R and Green baum, S 2002. A University grammar

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE101 T	Introduction to Agronomy and Horticulture	1	70	30	100

Theory-

Agronomy, scope and its role in crop production-Major Field crops of India – classification, area, distribution and productivity of major Field crops. Farming and cropping systems –mono, sole and multiple cropping, relay, sequential and inter cropping. Tillage- definition- objectives – types of tillage- tillage implements – tith - characteristics of good tith - Soil productivity and fertility- Crop nutrition – nutrients –classification – Nutrient sources- organic manures –fertilizers – biofertilizers- Integrated Nutrient Management-Importance of water in plant growth- Irrigation and drainage. Weed control – definition and characteristics of weeds, classification of weeds – damages due to weeds - benefits of weeds. -Control vs prevention of weeds – methods of weed control- Classification of herbicides–Integrated weed management. Definitions and importance of horticulture- Economic importance and classification of horticultural crops and their culture and nutritive value- area and production- exports and imports- fruit, vegetables, plantation and spice crops-soil and climate–principles- planning and layout- management of orchards- planting systems and planting densities- Principles and methods of pruning and training of fruit, plantation crops- use of growth regulators in horticulture crops-Horticultural zones of state and country.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE101 P	Introduction to Agronomy and Horticulture	1	100	-	100

Practical –

Identification of field crop and tillage implements. Preparation of seed beds, identification of fertilizers and manures – mixing chemical fertilizers – calculating fertilizer requirements. Identification of green manure plants. Identification of important weeds of the region with particular reference to forest plantations. Preparation of weed herbarium. Calculations of spray volume and herbicide concentrations. Methods of application of herbicides. Identification of horticultural crops-garden tools and implements. planning and layout of orchard and plantations. Digging and filling of pits for fruit and plantation crops-planting systems, training and pruning of orchard trees-preparation and application of regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits-bearing habits and maturity standards, harvesting, grading, packaging and storage.

Suggested Reading

- Agrawal, R.L.1980. Seed technology. Oxford & IBH Publishing Co., New Delhi
- Balasu bramaniyan, P and Palaniapan, S.P.2001. Principles and Practices of Agronomy. Agro Bios (India)Ltd., Jodhpur.
- Bose, T.K. 1985. Fruits of India- Tropical and subtropical. Naya Prakash, Calcutta
- Brady, N.C. and Well, R.R.2002. The Nature and Properties of Soils (13th ed.). Pearson

Education, Delhi.

- De, G.C.1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi
- Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management(7th ed.). Pearson Education, Delhi.
- ICAR.2006. Hand book of Agriculture, ICAR, New Delhi.
- Nair, P.K.R.1979. Intensive multiple cropping with coconuts in India. Verlag Paul Pary, Berlin
- Palaniappan, S.P. 1988. Cropping systems in the tropics - Principles and management. Wiley Eastern Limited, New Delhi
- Randhawa, M.S.1982. History of agriculture in India, Voll, II&III. ICAR, New Delhi
- Reddy. T.Yand Reddy, G.H.S.1995. Principles of Agronomy, Kalyani Publishers, Ludhiana.
- Reddy, S.R.1999. Principles of Agronomy, Kalyani Publishers, Ludhiana.
- Sankaran, S. and Subbiah Mudaliar, V.T. 1991. Principles of Agronomy. The Bangalore Printing & Publishing Co., Bangalore
- Tisdale, S.L. etal.1985. Soil fertility and fertilizers. Macmillan Pub.Co., New York

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE102 T	Information and Communication Technology	1	70	30	100

Theory-

Introduction to computers, hard ware and soft ware, basic works of computer, operating systems. DOS, WINDOWS commands for managing files. Windows component like icons, desktop, My Computer, recycle bin, My Documents, task bar, start menu options. Familiarizing with MS OFFICE (MS Excel, MS Word, MS PowerPoint). Introductions to FOSS for OS and for work related to word processing, spreadsheet and presentation. Introduction to intra and internet and its application. Introduction to statistical packages and image processing software. Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing. Communication process, Berlo' s model, feedback and barriers to communication.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE102 P	Information and Communication Technology	1	100	-	100

Practical –

Exercises on binary number system, algorithm and flow chart; MS Word; MS Excel; MS Power Point; Internet applications: Web Browsing, Creation and operation of Email account; Analysis of fisheries data using MS

Excel. Handling of audio visual equipments. Planning, preparation, presentation of posters, charts, overhead transparencies and slides. Organization of an audio visual programme.

Suggested Reading:

- ☒ Norton Peter, "DOS Guide", Prentice Hall of India
- ☒ Norton Peter, "Introduction to Computers", TMH
- ☒ Rajaraman V, "Fundamentals of Computers", PHI

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE103 T	Forest Botany	1	70	30	100

Theory-

Introduction to Allied and Applied Branches of Botany; General classification of plants – Phanerogams, Cryptogams, Angiosperms and Gymnosperms, Dicotyledons and Monocotyledons; General body organization and characters of Algae (e.g. Chlamydomonas), Fungi (Mucor), Bryophytes (Moss) and Pteridophytes (Nephrolepis); Parts of flowering plants- Root system and Shoot system, typical structure of root, stem and leaf; Functions of root, stem and leaves; Basic Structure of Flower- Essential and Non essential parts of flower; Morphology of root, stem and leaves; Morphology of Flower with emphasis on Inflorescence; Types of Phyllotaxy and Venation in leaves, types of placentation and aestivation in flower; Basic types of tissues (Structure and Function) - Dermal, Vascular and Ground tissues; Parenchyma, Sclerenchyma, Collenchyma, Chlorenchyma, Aerenchyma, Cambium, Xylem and Phloem; Types of vascular bundles in flowering plants.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE103 P	Forest Botany	1	100	-	100

Practical –

Morphology of root, stem and leaves with special emphasis on underground and aerial modifications in root and stem; simple and compound leaves; types of phyllotaxy and venation (live specimens); typical structure of bisexual flower; types of inflorescence (live specimens); types of tissues with the aid of permanently mounted slides; Tissue organization in Dicot root, stem and leaves; Tissue organization in Monocot root, stem and leaves with the aid of permanent slides or study charts.

Suggested reading:

- ☒ Ashok Bendre and Ashok Kumar. (1984). *Textbook of Practical Botany*. Vol. I and II. Rastogi Publications. Meerut. India. (Also available on Flipkart and Amazonbooks. Com)
- Ashok Bendre and P.C. Pande. (1996). *Introductory Botany*. Rastogi Publications. Meerut. India.
- ☒ Ashok Kumar (2001). *Botany in Forestry and Environment*. Kumar Media (P) Ltd. Gandhinagar, Gujarat.
- ☒ Dutta. C. (1998). *Botany for Degree Students*. (1998). Oxford University Press. India
- ☒ Dutta. C. (2000). *Class Book of Botany*. Oxford University Press. India
- ☒ Gurucharan Singh. (2000). *Plant Systematics*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- ☒ Pandey S. N. and S. P. Mishra. (2008). *Taxonomy of Angiosperms*. Ane Books India, New Delhi.
- ☒ Pandey. P. (2012). *Taxonomy of Angiosperms*. S. Chand and Company Ltd. New Delhi.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE104 T	Basics Mathematics	2	70	30	100

Theory-

Elementary idea of complex number. Arithmetic and Geometric progressions. Elementary idea of permutation and combinations. Matrix of a system of linear equations. Binomial theorem for positive integral index, any index and their applications, addition and subtraction formulae. A, B and C, D formulae. Sine and Cosine formulae. Inverse Trigonometric functions, ratios and their interrelationships. Limit off unctions- differentiations and integrations simple applications- maxima and minima least square techniques- Introduction to matrices and determinants, special type of matrices, addition, subtraction and multiplication of matrices.

Suggested Readings

- ☒ Chatterjee S. K. (1970). *Mathematical Analysis*. Oxford & IBH.
- ☒ Frank, A. (1962). *Schaum's Outline of Theory and Problems of Matrices*. McGraw-Hill
- ☒ Frank, A. 1967. *Theory and Problems of Differential Equations*. McGraw-Hill
- ☒ Gentle JE. (2007). *Matrix Algebra: Theory, Computations and Applications in Statistics*. Springer
- ☒ Narayan, S. (1953). *A Text Book of Matrices*. S. Chand and Company.
- ☒ Parameswaran, S. (1976). *An introduction to mathematics*. Oxford & IBH Publishing Co. 172p.
- ☒ Priestley, H.A. (1985). *Introduction to Complex Analysis*. Clarenton Press
- ☒ Walter R. (1976). *Principles of Mathematical Analysis*. McGraw-Hill.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	

SOA/FE105P	NCC-I/NSS-I*	1	-	-	-
<p>Theory-</p> <p>Introduction to NCC, defense services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, armsdrill, shoulderarm, orderarm, presentarm, guard of honour, ceremonial drill.</p> <p>NSS –</p> <p>Aims and objectives of NSS. NSS logo, mottoetc. Orientation of students in national problems, study of philosophy of NSS, funda mentals rights, directive principles of state policy, Village adoption.</p>					

* Non credit course

Total Credit to earn in the Semester I

Core	AECC	SEC	ELECTIVE	TOTAL
13	2	0	6	21

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM
 (CBCS)
 SCHEME OF INSTRUCTIONS AND CREDITS
 Details Syllabus**

Semester-II

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC106T	Plant Physiology	2	70	30	100
Theory-					
<p>Introduction to tree physiology. Photosynthesis - C₃, C₄ and CAM plants – Photorespiration Factors affecting photosynthesis. Respiration - energetics of dark respiration. Plant-water relations: Concept of water potential, ascent of sap and water balance. Stomatal physiology : stomatal conductance – resistance. Mineral nutrition: macro and micro nutrients Arnon’s criteria of essentiality – deficiency. Nutrient dynamics and plant growth – Nutrient cycling of C,N,P,S. Plant growth regulators – classification. Tree structure, growth and development, growth kinetics. Growth regulation and co-ordination- Plant growth analysis, Canopy strudius. Forest Biomes. Light interactions, models of forest canopies - Sun plants and shade plants shade tolerance. Temperature tempareture influence on forest development, energy budgets, low and high temperature - Physiological adaptations for high temperature, chilling injury. Water stress - Mechanism of drought tolerance and drought resistances - Physiological basis of drought, avoidance and tolerance. Water relations of forest trees – Transpiration from forest canopies – Evapotranspiration models of forest stands - Water use efficiency of forest stands. Salinity stress its effects on tree growth. Resistance to salinity. Forest and microclimate . Carbon balance and dry matter production in forest trees - Dry matter production and partitioning – source/ sink - . GPP and NPP of forest stands -Carbon cycling</p>					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC106P	Plant Physiology	1	100	-	100

Practical - C₃ and C₄ leaf anatomy. Estimation of transpiration using porometer. Extraction and estimation of chlorophyll in plants. Estimation of stomatal index. Demonstration of plasmolysis. Estimation of water potential in plants using Plant water status console. Estimation of leaf area of plants. Plant growth analysis – RGR (Rotative growth rate), NAR (Net assimilation rate), and LAR (Long area ratio), SLA (specific leaf area) and leaf weight ratio (WR), Long area index (LAI), CGR – LAD etc... Measurement of moisture stress tolerance parameters in trees - membrane stability, chlorophyll stability, proline content, wax and cuticle thickness. Measurement of relative water content, leaf water potential, osmotic potential. Measurements of stomatal resistance/stomatal conductance under varying stress condition. Observation on tree architecture of important species

Suggested Reading

- Hopkins, W.G. and Huner, N.P.A. (2008) Introduction to plant physiology. Wiley.
- Kramer, P.J. and Kozlowski, T.T. (1979). Physiology of Woody Plants. John Wiley and sons. New York
- Larcher, W. (2003). Physiological Plant Ecology: Ecophysiology and Stress Physiology of Functional Groups. Springer Science & Business Media
- Lambert, Chapin, F.S. and Pons, T.L. (1998). Plant Physiological Ecology. Springer Scientific+ Business Media inc. Newyork.
- Landsberg, J.J (1986). Physiological Ecology of Forest Production. Academic Press Inc., London
- Landsberg, J.J and Gower, S.T (1997). Applications of Physiological Ecology to Forest Managment. Academic Press Inc., London.
- Nobel P.S. (2005). Physicochemical and Environmental Plant Physiology. Elsevier Academic Press, Amsterdam
- Salisbury, F. B. and Ross, C. W. (2004) . Plant Physiology. Thomson Asia Ptd, Ltd. Singapore.
- Taiz, L. and Zeiger, E. (2010) 5th edition Plant Physiology. Sinauer Associates, Inc., Massachusetts

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC107T	Plant Cytology and Genetics	2	70	30	100

Theory-

History of genetics. Mendel's principles of inheritance – segregation – independent assortment. Cell – structure and functions. Cell organelles. Cell reproduction – mitosis – meiosis and its significance. Chromosome theory of inheritance. Modification to Mendelian inheritance – multiple alleles – codominance – gene interaction – epistasis – pleiotropy – polygenic inheritance penetrance and expressivity – cytoplasmic inheritance. Linkage and crossing over – cytological consequence of crossing over. Detection of linkage and linkage maps. Chromosomal aberrations- numerical and structural. Structure of DNA and types and its replication. Chromosomes – its structure and function. Fine structure of gene; Gene expression and their functions. RNA its structure function and types. Gene action – protein synthesis. Mutation, its classification and uses.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC107P	Plant Cytology and Genetics	1	100	-	100

Practical –

Study of fixatives and stains. Preparation of slides showing various stages of mitosis. Preparation of slides showing various stages of meiosis. Working out problems related to monohybrid cross, dihybrid cross, independent assortment,

linkage, gene mapping, probability and chi-square, multiple alleles etc.

Suggested Reading:

- Fletcher, H. and Hickey, I. (2012). Genetics. Garland Science,
- Garner, E. J., Simmons, M. J. and Sunstad, P. D. (2008). Principles of Genetics (8th edn.).Wiley India (P.) Ltd., Daryaganj, New Delhi.
- Gupta P. K. (1999). Cytogenetics Rastogi Publishers, Meerut
- Strickberger, M.W. (1996). Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi
- Tamarin, R. (2002). Principles of Genetic (7th Ed). Tata McGraw-Hill Education.
- White, T.L., Adams, W.T., and Neale, D.B. (2007). Forest Genetics. CABI

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC108T	Theory and Practice of Silviculture	2	70	30	100

Theory-

Definitions: Silviculture: Objectives and scope of silviculture-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. Silvicultural systems-definition, scope and classification. Systems of concentrated regeneration- systems of diffused regeneration- accessory systems- Clear felling systems- Shelterwood system - Selection system and its modifications- Coppice systems- Culm selection system in Bamboo, Canopy lifting system in Andaman. Silvicultural systems followed in other countries.

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, root sucker, regeneration survey, natural regeneration supplemented by artificial regeneration. 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.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	

SOA/FC108P	Theory and Practice of Silviculture	1	100	-	100
------------	-------------------------------------	---	-----	---	-----

Practical –

Acquaintance with modern silvicultural tools. Visits to different forest areas/types. Study of forest composition. Visiting plantations raised by forest department, Exercise on nursery practice- seed collection, seed pre-treatment- nursery stock preparation- 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.

Suggested Reading

- Baker, F.S.1950. Principles of Silviculture, Mc Graw Hill, N . Y .
- Champion, H.G. and Trevor,G.1936. Handbook of Silviculture, Cosmo Publication, N e w Delhi
- Daniel, T.W., Helms,J.A., Baker, F.S. 1970. Principles of Silviculture, Mc Graw Hill, N.Y.
- Duryea, M.L. and Landis, T.D.(eds.)1984. Forest Nursery Manual: Production of bareroot seed lings. Martinus Nijhoff/DrW. Junk Publishers. The Hague/Boston/Lancaster, 386p.
- Dwivedi. A.P. 1993. Text book of Silviculture. International Book Distributors.
- Evans, JE.1982. Plantation For estryinthe Tropics.The English Language Book Society and Clarend on Press–Oxford
- Gunter, S.,Weber, M,M Stimm, Band Mosandl, R. 2011. Silviculture inthe Tropics. Springer- Verlag-Berlin.
- Haig, I. T. Huberman, M. A. and Aung Din, U. 1986. Tropical Silviculture, Vol. I and II.
- Food andAgriculture Organization of the United Nations Rome andPeriodical Experts BookAgency, D-42, Vivek Vihar,Delhi–110032.
- Khanna, L.S.1989. Principles and Practice of Silviculture. Khanna Bandhu, 7 Tilak Marg, Dehradun
- Kostler, J.1956. Silviculture. International Book Distributors, P.O. Box4. Dehradun
- Lal, J.B.2003. Tropical Silviculture, New Imperatives: New Systems, International Book Distributors, P.O. Box 4. Dehradun
- Smith, D.M.1986. The Practice of Silviculture, Edn8. New York, John Wiley.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC109T	Forest Protection	2	70	30	100

Theory-

Introduction – Importance of protection in Indian Forestry – classification of injurious agencies. Injury to forest due to fires, causes and character of forest fires – fire prevention activity

fire suppression – fire fighting equipments – fire control policy and objectives. Fire fighting in other countries. Injury to forest due to man- lopping – cutting for fuel wood – Encroachment- different types, control of encroachment illegal felling of trees- method of control legislation. Forest weeds and weed management, management of woody climbers, parasites and epiphytes.

Importance of Forest Pathology, tree disease classification, Principles of tree disease management, - Causes and symptoms- losses due to forest tree diseases, root diseases (wilt, root- and butt rot), stem diseases (heart rots, stem blisters, rusts, stem wilt, cankers, pink diseases, gummosis, water blister) and foliar diseases (rust, powdery mildew, leaf spot, leaf and twig blight, abnormal leaf fall, needle blight etc.) Etiology, symptoms, mode of spread, epidemiology and management, including chemical, biological, cultural and silvicultural practices. Nursery diseases and their management. Disease due to physiological causes. Abiotic diseases.

Forest Entomology in India. Methods and principles of pest control: Mechanical, physical, silvicultural, legal, biological and chemical. Principles and techniques of Integrated Pest Management in forests. Classification of forest pests: types of damages and symptoms; factors for outbreak of pests. Nature of damage and management: Insect pests of forest seeds, forest nursery and standing trees of timber yielding species of natural forest and Plantation forest species. Insect pests of freshly felled trees, finished timbers and their management.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC109P	Forest Protection	1	100	-	100

Practical –

Visit to forest areas with fire damages, studying fire registers as records, studying encroachments and problems caused due to disturbance-visit to illegally felled areas- Visit to fire station, study and acquaint with machinery used for fire control, identification of weeds, parasites and epiphytes. Observation of symptoms in laboratory and in forests - examination of scrapings - host-parasite relationships - causal organisms of above forest diseases. Examination of cultures of important pathogens. Visit to nurseries and plantations. Insect pests of forest seeds; forest nurseries; standing trees; freshly felled trees and finished products. Survey and identification of invertebrate fauna from forest areas. Methods of isolating soil invertebrate macro and micro fauna. Insecticides and their formulations, plant protection appliances.

Suggested Reading:

- Agrios, G.N. (1997). Plant Pathology. 4thEdn, Horcourt Asia Pvt. Ltd., Singapore.
- Bakshi, B.K. (1976), Forest Pathology; Principles and Practices in Forestry. Pub. Comptroller of Publications, Delhi. 400p.
- Basher, A.E.S. (1983).Forest Fires and Their Control. Gulab Primlani Amerind Publishing, New
- Boyce, J.S. (1961). Forest Pathology, 3rd edition. McGraw-Hill. New York, New York. 572 pp
- Brown, A.A and Davis, K.P. (1973). Forest Fire Control and Use. Mc Graw Hill Book Co. New York. Delhi.159p.
- Devasahayam, H.L. and Henry, L.D.C. (2009). Illustrated Plant Pathology- Basic Concepts.

New India Publishing Agency

- Elton, C. S. (2000). The Ecology of Invasions by Animals and Plants. University of Chicago Press.
- Fuller, M. (1991). Forest Fires. Wiley Nature Editions, New York.
- Ghadekar, S.R. (2003) Meteorology. Agromet Publishers, Nagpur
- Hal, R.B. (1990). Principles and Procedure of Range Management. International Book

Distributors, Dehra Dun.

- Johnson, A.E and Miyanishi, K. (2001). Forest Fires: Behavior and Ecological Effects. Academic Press.
- Khanna, L.S. (1988). Forest Protection. Khanna Bandhu, Dehradun.206p.
- Lenka, D. (1997) Climate, weather and crop in India. Kalyani Publishers, New Delhi
- Luna, R.K. (2007). Principles and Practices of Forest Fire Control.International Book Distributors, Dehradun.466p.
- Mavi, H.S. (1994) Agrometeorology. Oxford &IBH, New Delhi
- Mohanan, C. (2011). Macro fungi of Kerala, KFRI, Peechi.p.597
- Negi, S.S. (1999). Handbook of Forest Protection. International Book Distributors.271p.
- Pathak, V.N., Khatri, N.K. and Manish Pathak. (2000). Fundamentals of Plant Pathology. Eds. Agribios (India), Jodpur. 356 p.
- Rao, GSLHVP (2003) Agrometeorology, KAU, Thrissur, Kerala,
- Seemann, J., Chirkov, Y.I., Lomas, J., and Primault, B. (2012) Agrometeorology. Springer Berlin Heidelberg
- Singh, R.S (2002).Introduction Principles of Plant Pathology. Oxford & IBH, New Delhi
- Varshney, M.C. and Pillai, P.B. (2003) Textbook of Agrometeorology. ICAR, New Delhi

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FAECC102T	Statistical Methods & Experimental Designs	2	70	30	100

Theory-

Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data. Construction of frequency distribution, tables –graphic presentation of data, simple, multiple component and percentage, bar diagram, pedia gram, histogram, frequency polygon and frequency curveave rage and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poisson and normal distributions, sampling, basic concepts, sampling vs. Complete enumeration parameter and static, sampling methods, simple random sampling and stratified and om sampling. Tests of significance: Basic concepts, tests fore quality mean, aninde pendet and paired t-tests, chisquare tests for application of attributes and test for goodness to fit of mendalian ratios. Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of sample linear regression, tests of significance of correlation and regressionco-efficient. Introduction to design of experiment- Basic principles of experimental design-replication, randomization and local control. Analysis is of variance-assumptions-construction of ANOVA table–conclusions based on ANOVA. Comparisons basedon means-critical difference, DMRT. Transformations of data- square root, logarithmic and angulartrans for mations. Completelyr and omized design-Layout, analysis, advantages and limitations. Randomised block design-layout, analysis, choice of no. of blocks, advantages and limitations. Latin square designs-layout, analysis, applications, advantages and limitations.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FAECC102P	Statistical Methods & Experimental Designs	1	100	-	100

Practical –

Formation of frequency distribution. Diagrammatic and graphic representation. Calculation of different measures of central tendency. Computation of various measures of dispersion. Calculation of coefficient of variation-coefficients of skewness and kurtosis. Computation of product moment correlate on coefficient-rank correlation, coefficient-and coefficient of concordance. Fitting of linear regression models for prediction. Simple problems on probability- fitting of binomial distribution. Fitting of poisson distribution, problems on normal distribution. Selection of simple random sample – estimation of parameters – sample size determination. Selection of stratified and om sample–equal, proportional and Ney man’s allocation in stratified sampling. Large sample tests. Small sample tests, t and F tests, Chi –square test, test of goodness of fit – test of independence of attributes in a contingency table- computation of mean–square contingency. Analysis of variance-construction of ANOVA table of one-way classified data. Analysis of variance-construction of ANOVA table of two-way classified data. Layout and analysis of CRD, Layout and analysis of RBD. Analysis of data from 2n factorial experiments in RBD. Formation of Yate's table-calculation of main effects and interaction effects. Layout and analysis of split-plot design.

Suggested Reading

- Anderson, R.L. and Bancroft, T.A.(1952).Statistical Theory in Research. Mc. Graw Hill Book Co., New York.
- Cochran, W.G and Cox, G.M.(1958). Experimental designs. Wiley, New York
- Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments. Wiley Eastern Ltd., New Delhi.
- Federer, W.T.(1955), Experimental Design. Macmillan, New York.
- Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons. New York. 680p.
- Kempthorne, O. (1952). The design and analysis of experiments. Wiley, New York.
- Nigam A.K. and Gupta, V.K.(1979). Hand boo kon Analysis is of Agricultural Experiments. IASRI Publication, New Delhi.
- Panse, V. G. and P.V. Sukhatme. (1967). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, India.
- Petersen Roger G. (1994) Agricultural Field Experiments: Design and Analysis. Marcel Dekker, New York.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE106T	Wood Anatomy	2	70	30	100

Theory-

Introduction to wood anatomy. Kinds of woody plants- Gymnosperms versus angiosperms. The plant body; a tree

and its various parts. Meristems; promeristem, primary meristem, secondary meristem. Simple tissues; parenchyma, collenchyma, sclerenchyma and the vascular tissues. Parts of the primary body; typical stems and roots of dicots and monocots. Secondary growth in woody plants. Mechanism of wood formation in general, and with special reference to typical dicot stem. Ray initials and fusiform initials; anticlinal and periclinal division. Physiological significance of wood formation. The macroscopic features of wood, sapwood, heartwood, pith, early wood, late wood, growth rings, wood rays, etc. Sapwood versus heart wood, anatomical differences. Transformation of sapwood to heartwood; factors affecting transformation. Microscopic features of wood. Prosenchymatous elements, tracheids, vessels, fibers. Parenchymatous elements, parenchyma and rays, resin canals, gum canals, latex canals, infiltrants in wood. Three dimensional features of wood; transverse, tangential and radial surfaces. Elements of wood cell walls. The structure and arrangement of simple pit, bordered pits. Extractives in wood. Comparative anatomy of gymnosperms and angiosperms. Anatomical features of common Indian timbers; classification into porous and nonporous woods, ring porous and diffuse porous woods. Effect of growth rate on wood properties. Juvenile wood and mature wood.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE106P	Wood Anatomy	1	100	-	100

Practical –

Study of primary growth in stems of typical dicots and monocots. Study of wood formation in typical dicot stem. Study of vascular bundles in monocots. Parts of the logs (woody trunks), and the three distinctive surfaces of wood (i.e. cross, radial and tangential planes). Timber identification and its importance. Procedures for field identification of timbers. Study of physical features of wood. Study of gross features of wood. Study of anatomical features of wood, pores or vessels, different types. Study of soft tissue in timbers and their different types distributions. Study of wood rays, and their different types. Study of the non-porous woods, their physical and anatomical description. Study of infiltration and inclusions in wood. Anatomical keys and methods to use them. Dichotomous keys, punched card keys and computer aided identification. Field identification of important timbers of Uttarakhand.

Suggested Reading

- Anoop, E. V., Antony, F., Bhat, K. V. Lisha, D. A. and Babu, L. C. 2005. Anatomical key for the identification of important timbers of Kerala. Kerala Agricultural University, Thrissur and Kerala State Council for Science, Technology and Environment, Thiruvananthapuram, Kerala, India. 126p.
- Hoadley, B. 2000. Identifying wood-Accurate results with simple tools. Taunton Press, Newtown, USA. 223p.
- Panshin, A. J. and De Zeeuw, C. 1980. Textbook of wood technology, 4th Ed. McGraw-Hill. New York, USA: 722p.
- Rao, R. K. and Juneja, K. B. S. 1992. Field identification of fifty important timbers of India. Indian Council of Forestry Research and Education, New Forest, Dehra Dun. 123p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE107T	Environmental Studies and Disaster Management	2	70	30	100

Theory-

Environmental studies: definition, scope and importance. Natural Resources, Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Ecosystems-Concept of an ecosystem, structure and function of an ecosystem. Biodiversity and its conservation, Value. Environmental Pollution, Solid Waste Management, Social Issues, Environmental ethics, Wasteland reclamation, Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness, Environment and human health, Women and Child Welfare, Natural Disasters, Climatic change, Man Made Disasters, Disaster Management.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE107P	Environmental Studies and Disaster Management	1	100	-	100

Practical –

Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/mountain, visit to a local polluted site-Urban/ Rural/ Industrial/ Agricultural, Study and documentation of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc. Assessing environmental issue of a area, town, institutional company etc.

Suggested Reading:

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. Coping with catastrophe. Handbook of Disaster Management. Routledge.
- Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE108P	NCC-II/NSS-II*	1	-	-	-

Theory-

NCC-II- Weapon training – rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush.

* Non credit course

Total Credit to earn in the Semester II

Core	AECC	SEC	ELECTIVE	TOTAL
12	3	0	6	21

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM
(CBCS)
SCHEME OF INSTRUCTIONS AND CREDITS
Details Syllabus
Semester III**

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC110T	Forest Survey and Engineering	2	70	30	100

Theory-

Forest survey, scope and types of surveying, chain surveying- types and instruments used- Traversing, triangulation, survey stations, base line, check and tie lines; ranging of survey lines; offsets and their types; chain of slopy grounds, chaining across obstacles; cross staff surveying, Areas of irregularly bounded fields- different methods; Simpson's, trapezoidal rule; compass surveying, chain and compass traversing, magnetic and true bearing, prismatic compass, local attraction. Computation of interior angles and balancing of closed traverse. Plane table surveying:- plane table and its accessories, methods of plane table surveying. Leveling: terms used types of level. Theodolite and its uses. Contour surveying. Buildings materials- types, strength and characteristics, site selection for building construction, forest roads- alignment, construction and drainage; retaining walls, breast wall, water ways and culverts, Bridges-types, selection of site, simple wooden beam bridge, check dams, spurs, farm ponds, earth dams.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC110P	Forest Survey and Engineering	1	100	-	100

Practical –

Chain surveying, compass traversing; plane table surveying, leveling, calculations of earth work for construction of forest, roads & earth dams; alignment of forest roads; preparation building plans; design of water ways; design of simple wooden beam bridge; design of retaining walls. Design of check dams.

Suggested Reading

- Kanetkar, T.P. and Kulkarni, S.V. (1989). Surveying and levelling. Vidyarthi Griha Prakashan, Pune.
- Masani, N.J. (2006). Forest Engineering -without tears (2nd edition). Natraj Publishers, Dehra Dun.
- Murthy, V.V.N. (1985). Land and water management engineering. Kalyani Publishers, New Delhi.
- Parkash, R. (1983). Forest Surveying, International Book Distributor
- Punnia, B.G. (1987). Surveying Vol I. Laxmi Publishers, New Delhi.
- Sahani, P.B. (1979). Text Book of Surveying Vol. I & II. Oxford and IBH, New Delhi.

Course Code	Name of Subject	Credit	Marks	Total
-------------	-----------------	--------	-------	-------

			External	Internal	
SOA/FC111T	Tree Improvement	2	70	30	100

Theory-

Introduction – history and development of tree improvement – its relation to other disciplines of forestry. Reproduction in forest trees. Anthesis and pollination – their importance in tree breeding. Incompatibility and sterility. Quantitative inheritance. Relevance in forestry. Natural variability in trees – types and importance.- forces that change variability. Genetic, environmental and interaction components of variation - heritability and genetic advance. Genetic basis of tree breeding.Exotic forestry. Provenance testing. Selection- Seed production areas–seed orchards. Progeny trial and improvement of seed orchards. Combining ability and genetic gain – Hybridization in trees – back cross breeding, heterosis breeding. Breeding for resistance to insect pest’s diseases, air pollution and for wood properties. Vegetative propagation and clonal forestry. Conservation of forest tree germplasm. Recent techniques in tree improvement.

Mutation breeding; Ploidy breeding. Breeding objectives and concepts of breeding in self pollinated, cross pollinated and vegetatively propagated crops. Breeding of important tree species. Breeding procedures for development of hybrids, / varieties of various crops. DUS testing, Concepts of Geographical indications. Artificial hybrids in trees-crossing in trees-problems and perspectives-crossing hybrids and hybrid breakdown. Hybrid nomenclature in trees- Future of hybrid in applied tree improvement.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC111P	Tree Improvement	1	100	-	100

Practical –

Floral biology and phenological observations in some important species. Pollen morphology. Estimation of pollen sterility and viability. Emasculation and hybridization in forest tree species. Different breeding methods – flow chart. Recording observations in provenance trial. Estimation of phenotypic and genotypic coefficient of variation. Estimation of genetic advance, heritability and GCA. Exercise in plus tree selection – recording data – design and observation in teak, eucalyptus seed orchard.

Suggested Reading:

- Allied T.L. White and Adams (2010). Forest Genetics.Bedell P. E. (2007). Tree Breeding for Genetic Improvement of Tropical Tree Species (1st Ed).
- Surendran, C., Sehgal, R.N. and Parmathma, M. (Eds.) (2003). A text book of Forest Tree Breeding. ICAR, New Delhi.
- Wright, J. (2012). Introduction to Forest Genetics. Elsevier.
- Zobel, B. and Talbert, J. (2003). Applied Forest Tree Improvement. Blackburn Press.

--

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC112T	Principles of Agroforestry	2	70	30	100

Theory-

Overview of the Agriculture scenario – its structure and constraints. Concept of sustainable agriculture and land use management. Paradigm shift in Agriculture development- impacts of green revolution, Agrobiodiversity, significance, threats and conservation strategies. Agroforestry definition and scope – rising demands of fuel wood, fodder and timber. Social, ecological, and economic reasons for agroforestry. History of agroforestry. Components of Agroforestry- provisioning and regulator services of agroforestry- Nutrient cycling, Soil improvement, Increased production and productivity, Microclimate amelioration and carbon sequestration Tree-crop interaction in agroforestry– Definition, kind of interaction – Positive interactions- complementarity - compatibility - mutualism, commensalism - Negative interactions – allelopathy and competition-Interaction management - Aboveground and belowground interactions- Manipulation of density, space, crown and roots. Tree Management – structure and growth of trees, crown and root architecture, agroforestry practices to minimize negative interaction – coppicing, thinning, pollarding and pruning – Crop planning and management –selection of suitable crops –management of nutrients, water and weeds – Classification of agroforestry systems – National Agroforestry Policy 2014—National and International organizations in Agroforestry. MPTs & N₂ Fixing trees in Agroforestry, Diagnosis & Design in Agroforestry land capability classification.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC112P	Principles of Agroforestry	1	100	-	100

Practical –

Traditional agroforestry systems in the country and visits to some of the local agroforestry systems. Agroforestry systems in different agroecological zones- their structural and functional features. Visit to on farm agroforestry models. Studies on fodder banks and live fences. Studies on light and below ground interactions in agroforestry systems- MPTs and Nitrogen fixing trees in agroforestry- Studies on allelopathy- Design & Diagnostics exercise in agroforestry- land capability classification of various topographic regions- Visit to industrial plantations.

Suggested Reading

- Huxley, P.A. 1983 (ed). Plant Research and Agroforestry, ICRAF, Nairobi, Kenya.
- Huxley, P. 1999. Tropical Agroforestry. Wiley: 384p.
- 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
- Michael, P. 1984. Ecological Methods for Field and Laboratory Investigations. Tata McGraw- Hill Pub. Co. New Delhi.
- 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.
- 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.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC113T	Forest Mensuration	2	70	30	100

Theory-

Forest Mensuration - Definition and objectives, Scales of measurement, Units of measurements, Precision, bias and accuracy, Diameter and girth measurements- Breast height measurements instruments used, Measurement of height-Definitions, Methods of measurement of height- ocular-non instrumental and instrumental methods, sources of error in height measurements- leaning trees. Tree stem form-Metzgr's theory –form factor- types of form factor, form height for quotient, form class. Volume measurements of standing trees, logs, branch wood-formulae- involved, definitions, volume tables-preparation of volume tables-graphical method-regression method- Determination of growth of trees- Increment-CAI & MAI- increment percent-increment borer- Stump analysis- Stem analysis. Measurement of tree crops-objects-crop diameter-crop height-crop age-crop volume.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC113P	Forest Mensuration	1	100	-	100

Practical –

Determination of pace length- Measurements of diameter, girth and basal area of trees using Callipers, Tape, Ruler, Penta Prism, Tree Calliper etc. Measurement of height using non instrumental method- Preparation and use of simple height measuring instruments- Christens Hypsometer-Smithies Hypsometer- Modified Smithies Hypsometer-Measurement of tree height using instrumental methods- Abneys level- Haga altimeter- Relaskop- Clinometer- Blumeleiss Hypsometer-Laser Hypsometer- Volume determination of standing and felled trees. Exercise on Stump analysis. Exercise on stem analysis-Annual ring counting using ring borer. Preparation of volume tables- local volume table.

Suggested Reading

- Chaturvedi, A.N and L.S. Khanna. 2011. Forest Mensuration and Biometry (5th edition). Khanna andhu. 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.

Skill Enhancement Course (SEC)

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC101T	Soil Biology and Fertility	2	70	30	100

Theory-

Introduction - forest soils vs. cultivated soils, special features of forest soils, forest soil formation and vegetation development. Pedogenic processes – Podzolization and Laterization. Properties of soils under different forest ecosystems. Forest floor – stratification – types of humus. 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. Forest soil-biology-distribution of various microorganisms in soil ecosystem and their interaction effects. Role of microorganisms in soil fertility. Mineral transformations-carbon cycle with reference to organic matter decomposition and humus formation, Microbial degradation of cellulose & lignin. Bio-fertilizers – their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia X non-legume symbiosis, asymbiotic and associative N₂ fixation. Nitrification and denitrification in forest ecosystems. Microbial transformation of phosphorous, sulphur, and micronutrients. Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. Rhizosphere and phyllosphere concept. Fertility management of forest soils.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC101P	Soil Biology and Fertility	1	100	-	100

Practical –

Study of forest soil profile; Estimation of pH and EC –Organic carbon – available N, P, K, Ca, Mg, S and micronutrients – Determination of CEC and exchangeable cations; Interpretation of soil and plant analysis data for fertilizer recommendation. Basic sterilization techniques; culturing and maintenance of micro organism occurring in soil; Staining methods; Study of decomposition of forest litter by CO₂ – evolution method;

Estimation of nitrification rate in soil; Isolation of legume bacteria and Azotobacter; Preparation and inoculation techniques for mycorrhizae and biofertilizers.

Suggested Reading

- Brady, NC. The Nature and Properties of Soils. Mac Millan Pub. Comp. New York.
- Burges, A. and Raw, F. 1967. Soil Biology. Acad. Press, New York
- Mengel, K. and Kirkby, A. 1978. Principles of Plant Nutrition. International Potash Institute, Switzerland
- Pritchett and Fisher RF 1987. Properties and Management of Forest Soils. John Wiley, New York.
- Tisdale, L. S. Nelson, L.W. and Beaton, J. D. 1985. Soil Fertility and Fertilisers. Macmillan Publishing Company, New York
- Young, A. 1989. Agroforestry for Soil Conservation. CAB International, U.K.

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE109T	Wildlife Biology, Ornithology & Herpetology	2	70	30	100

Theory-

Unit- I. History of Wildlife studies in India; Classification of Indian Mammals, Basic requirements of wildlife – food, water, shelter, space, limiting factors; Food chain, Food web, Ecological pyramids; Wildlife Ecology: Biotic factors, Biological basis of wildlife, Productivity; Effect of light and temperature on animals; Wildlife Habitat: Niche, Territory, Home Range, Territoriality, Edge, Cruising Radius, Carrying Capacity; Animal behavior and adaptation; Habitat Improvement: Food, Water, Shelter improvement.

Unit - II. Introduction. History of ornithology in India. A brief knowledge of bird anatomy, morphology and physiology, digestive, skeletal, respiratory, excretory systems of birds. Skeleton, feathers, skin, beak and taxidermy. Thermoregulation in birds. Bird ecology and behaviour; migration and territorial behaviour, feeding, song and nests. Water birds, scavenger birds, frugivorous birds, pest birds, pet birds and pollinator birds. Importance of birds to different ecosystems. Birds and man. Bird watching, Bird conservation and management in India. Important Bird areas of India, Red Data Book birds of India. Wetland conservation, Ramsar sites of India.

Unit-III. Amphibians and Reptiles and - Distinctive features of identification of snake, crocodile, turtle and tortoise. Class Amphibia - evolution, Salient features. Nutrition, Respiration. Locomotion and Reproduction.

Class Reptilia - Evolution and salient features, Nutrition, Respiration, Locomotion and Reproduction. Turtle, Tortoise, Terrapins, Indian Lizards, Sphenodon, Indian Snakes Crocodiles.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE109P	Wildlife Biology, Ornithology & herpetology	1	100	-	100

Practical –

Unit-I. Visit to various protected areas and observations on the morphological, behavioral, feeding and reproductive activities of different species of wild animals in India. Various study methods on the wild animals, such as focal animal sampling, Sherman trapping, mist netting, camera trapping, for identification, determination of age and sexing of animals including the small mammals. Faecal analysis of wild animals.

Unit-II. Field identification of major birds of India. Bird watching and drawings. Study of feathers, beak and leg types of different groups of birds. Study of the nest and eggs of birds. Mist netting and tagging/marketing of birds for the bird migration studies. Bird census techniques. Visit to different bird habitats.

Unit-II. Identifications of amphibians of Uttarakhand. Sexual Dimorphism in amphibians. Identification of Reptiles. Handling of Reptiles (Indian snakes and others)

Suggested Reading

- Ali, S. and Ripley, D.S. 1990. A compact Handbook of Birds of Indian subcontinent. Oxford University press, Bombay.
- Daniel, J.C. 2002. The Book of Indian Reptiles. Bombay Natural History Society, Bombay, 141pp.
- Das, I. 1995. Turtles and Tortoises of India. Oxford University Press. Bombay. 176pp.
- Das, I. 2002. A photographic guide to Snakes and other reptiles of India. New Holland Publishers (UK) Ltd.
- Grimmet, R. Inskipp T and Inskipp, I. 2003. Handbook of Birds of Indian subcontinent. Oxford University press
- Grimmet, R. Inskipp, T and Nameer, P.O. 2007. Birds of southern India, BNHS series.
- Gururaja KV. 2012. Pictorial Guide to frogs and toads of the Western Ghats. IISc. Bangalore.
- Kazmierczak, K. and van Perlo B. 2000. A field guide to the birds of the Indian subcontinent, Yale University Press, New Haven. CT.
- Kentwood D. Wells. 2007. The Ecology and Behavior of Amphibians. The University of Chicago Press, Chicago.
- Rasmussen P C and John C. Anderton. 2012. *Birds of South Asia: The Ripley guide*. Vol. I and II, Smithsonian Institution and Lynx Edicions, Washington DC and Barcelona.
- Wallace GJ and HD Mahan. 2005. An Introduction to Ornithology. 3rd Ed. McMillan publishing company. New York.
- Whitaker, R. and Captain, A. 2004. Snakes of India. The Field Guide. Draco Books.

Chengalpattu, Tamil Nadu, xiv+479, pls, text-figs.

- William E. Duellman and Linda Trueb. 1986. Biology of Amphibians. John Hopkins University Press, Maryland.
- Vidyarthi, L.P. and Rai, B.K. 1985. The tribal culture of India. Concept Publ. Co., New Delhi.
- Berwick, S.H. and Saharia, V.B. 1995. Wildlife Research and Management. Oxford university Press, New Delhi.

- Dasmann, R.F. 1982. Wildlife Biology. Wiley Eastern Ltd. New Delhi.
- Davil, J.W. et al. 1981. Infectious diseases of wild mammals. Ed. II. Iowa State University Press, USA.
- International Zoo Books, Published by New York Zoological Society, New York
- Johnsingh, A.J.T. and N. Manjrekar. 2014. Mammals of South Asia. Vol. I. University Press, 614p
- John singh, A.J.T. and N. Manjrekar. 2015. Mammals of South Asia. II. University Press, 739p
- Krebs C & Davis N. 1978. Introduction to behavioral ecology. Oxford University Press
- Mathur R. 1985. Animal Behaviour. Oxford University Press
- Menon V. 2014. Indian Mammals: A field guide. Hachette. 528p.
- Mittermeier, RA Rylands, AB and Wilson DE. 2013. Handbook of the Mammals of the World - Volume 3. Lynx Edicions. 952.
- Prater, S.H. (1971). The Book of Indian Animals. Oxford University press, Bombay. 324p.
- Sukumar, R. Asian Elephant. Ecology and Management. Oxford University Press Cambridge.
- Wilson, DE Mittermeier RA. 2009. Handbook of the Mammals of the World - Volume 1. Lynx Edicions. 728.
- Wilson, DE Mittermeier RA. 2011. Handbook of the Mammals of the World - Volume 2. Lynx, Edicions. 886.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE110T	Forest Ecology and Biodiversity	2	70	30	100

Theory-

Historical development of ecology as a science. Levels of biological organization. Major forest Ecosystem. Forest environment- major abiotic and biotic components and their interaction, Nutrient cycling, trophic levels, food webs, ecological pyramids and energy flow. Population ecology - definition, population dynamics and carrying capacity, 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. Island Biogeography. Autecology of important tree species. Perturbation ecology- Biodiversity and conservation – definition, levels of study, distribution of diversity in life forms, hotspots of biodiversity, measurement of diversity and diversity indices. Principles of conservation biology, Ex-situ and In-situ methods of conservation, Genetic and evolutionary principles in conservation. Biosphere concept. Conservation – efforts in India and worldwide.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE110P	Forest Ecology and Biodiversity	1	100	-	100

Practical –

Study of ecological modifications in plants; Effects of fire on forest ecosystem; Study of population dynamics using model systems; Preparation of life tables; Study of spatial dispersion among plants; Study of Forest

composition; Niche analysis; Computation of diversity indices; Measurement of diversity of plants and insects in a nearby forest; Study of succession in field and water bodies; Visit to different ecosystems.

Suggested Reading

- Odum EP 1983. Basic Ecology. Saunders College Publishing, Philadelphia etc. 613p
- Misra KC 1974. Manual of Plant Ecology. Oxford & IBH Pub Co. New Delhi etc. 491p
- Michael P. 1984. Ecological Methods for Field and Laboratory Investigations. Tata McGraw-Hill Pub. Co. New Delhi, 404p
- Montagnini, F and Jordan, C.F. 2005. Tropical Forest Ecology: The Basis for Conservation and Management. Springer. 295p.
- Frankel, O.H., Brown, A.H.D., Burdon, J.J. 1995. The Conservation of Plant Biodiversity. Cambridge University Press. Cambridge. 299p
- Sagwal, S.S. 1995. Forest Ecology of India. Pioneer Publishers, India. 368p

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE111P	NCC-III/NSS-III*	1	-	-	-

Theory-

NCC-III Field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counterattacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song.

NSS-III- Awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition, village adoption- continued.

* Non credit course

Total Credit to earn in the Semester III

Core	AECC	SEC	ELECTIVE	TOTAL
12	0	3	6	21

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC114T	Forest Management	2	70	30	100

Theory-

Unit I. Definition, scope, objective and principles of forest management, organization of state forests- sustained yield-definition, principles and limitations. Sustainable forest management-criteria and indicators-Increasing and progressive yields-Rotation -definitions-various types of rotations- length of rotations-choice of type and kind of rotation. Normal forest-definitions basic factors of normality. Factors governing the yield and growth of forest stands.

Unit II. Working plan-preparations- objectives and uses-forest maps and their uses. Joint forest management-concept and principles- Modern tools in forest management. Introduction to the concept of forestry as a common property resource– Definition, Scope and necessity of community forestry.

Unit III. Forests and man- Forestry in support to agriculture, animal husbandry and horticulture – development of cottage industry in rural environment-NFP 1988 and the importance of people in forest conservation. Community forest management, Community forest development, social economical and environmental aspects, Community forest development through NGOs, civil societies, citizen groups- Gender dimensions in Community forest management.

Unit IV. Social Forestry- definition –NCA report of 1976- need and purpose- Social Forestry for – fodder production – fuel wood – leaf manure–timber production. Integrated rural development approach – with proper marketing facility – employment generation in raising, tending and harvesting of tree crops. Place of social forestry in the national forest policy of India-role of forest department.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC114P	Forest Management	1	100	-	100

Practical –

Visit to different forest divisions to study the various stand management aspects including thinning, felling and sale of timber. Study forest organizational set up and forest range administration including booking of offences. Visit to forest plantation- Field Exercise for the estimation of actual growing stock and volume. Field visit to JFM operational areas. Study the different field exercises for data collection for working plan.

Suggested Reading

- Balakathiresan, S (1986).Essentials of Forest Management, Nataraj Publishers, Dehradun.
- Bhatta charya P.,Kandya 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.
- Jerome L Cutteretal. (1983). Timber Management: A Quantitative Approach.John Wiley and Sons
- 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.

Note: Theory (T) and Practical (P) are linked to each other.

Detailed Syllabus – Semester IV

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC115T	Silviculture of Indian Trees	2	70	30	100

Theory-

Unit I. Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems, stand management practices pest and diseases and economic importance of the following tree species of India. Broadleaved species: *Tectona grandis*, *Shorea robusta*, *Dalbergia latifolia*, *Dalbergia sissoo*, *Anogeissus* spp, *Terminalia* spp., *Santalum album*, *Swietenia macrophylla*, *Albizia* spp, *Pterocarpus marsupium*, *Gmelina arborea*, *Pterocarpus santalinus*, *Azadirachta indica*, *Hopea parviflora*, *Lagerstroemia microcarpa*, Bamboos, reeds and rattan, *Quercus* spp.

Unit -II. Conifers: *Abies pindrow*, *Picea smithiana*, *Cedrus deodara*, *Pinus roxburghii*, *Pinus wallichiana*. Fast growing MPTs: Tropical pines, *Eucalyptus* spp, *Casuarina equisetifolia*, *Leucaena leucocephala*, *Ailanthus triphysa*, *Grevillea robusta*, *Pongamia pinnata*, *Melia dubia*, *Acacia* spp, *Populus* spp.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC115P	Silviculture of Indian Trees	1	100	-	100

Practical –

Study the morphological description and field identification characteristics of trees, seeds and seedlings. Phenology, Collection of seeds. Planting and stand management practices of *Tectona grandis*, *Dalbergia latifolia*, *Santalum album*, *Swietenia macrophylla*, eucalypts, acacias, bamboos, fast growing MPTs etc. Study the silviculture of trees in response to light, fire, drought, frost, root suckering, coppicing and pollarding, etc. Visit various problem areas and study on species suitability. Visit forest plantations and other woodlots. Study the planting density and stand management regimes for various end uses such as timber, pulpwood, plywood, cottage industries etc.

Suggested Reading

- Bebarta, 1999. Teak: Ecology, Silviculture, Management and profitability, IBD, Dehra Dun
- Champion, H.G. and A.L. Griffith. 1989. Manual for General Silviculture for India
- ICFRE booklets on tree species
- Kadambi, K. 1993. Silviculture and Management of teak. Nataraj Publishers, Dehra Dun. p.137.
- Lamprecht H 1989. Silviculture in the Tropics. GTZ, GmBH, FRG
- Troup, RS 1922. Silviculture of Indian Trees, Vol. 1-4, Revised and Enlarged Edition, Forest Research Institute and Colleges, Dehra Dun, 1975.
- Renuka, C., Pandalai, R.C. and Mohanan, C. 2002 Nursery and silvicultural techniques for rattan, Kerala Forest research Institute.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC116T	Wood Products & Utilization	2	70	30	100

Theory-

Unit I. Uses of wood. Growth of wood based industry in India, effect of globalization. Importance of forest based industries in relation to Indian economy. Wood as a source of energy and chemicals, wood as raw material for industries like pulp, paper, rayon, composite woods and improved woods.

Unit II. Description of different forest based industries - paper and pulp, furniture, bamboo, sports goods, pencil making, match box and splint making, use of wood of lesser known forest species for commercial purposes. Structural uses of Timber – bridges and other super structures. Decorative uses of wood. Introduction to wood modification, its need and scope, chemical modification of wood (acetylation, reaction with isocyanates, acetates, ethers, epoxides etc.). Primary conversion; sawing and veneering.

Unit III. Composite wood; plywood, laminated wood, core board, sandwich board, fibre board, particle board;

manufacturing process, uses and properties. Adhesives used in manufacture of composite wood. Improved wood; compressed wood, impregnated wood etc.; manufacturing process, uses and properties.

Unit IV. Nano technology in wood. Manufacture of rayon and match. Wood carving and handicrafts. Destructive distillation of wood. Saccharification of wood. Production of wood molasses, alcohol and yeast. Biochar, technology, bioenergy concepts - short rotation crops as raw materials.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC116P	Wood Products & Utilization	1	100	-	100

Practical –

Estimation of specific gravity and calorific value of wood specimens. Maceration techniques and determination of sizes of fibres, vessels etc. Visits to various wood based industries like, plywood, packing case, match, tannins, furniture, saw mills etc. to study the manufacturing process. Visit to saw mill to study veneering and different kinds of sawing. Handicraft manufacturing unit. Visit to wood distillation unit. Visit to nearby industrial plantations.

Suggested Reading

- Baldwin, R. F. 1981. Plywood manufacturing practices. Revised 2nd Ed. Miller and Freeman Publication, Inc. USA. 388p.
- FRI [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute and colleges, Dehradun. 941p.
- Hoadley, B. 2000. Understanding Wood: A Craftsman's guide to wood technology. Taunton Press. Newtown, USA. 223p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC117T	Ethnobotany, Medicinal and Aromatic Plants	2	70	30	100

Theory-

Definition and scope of ethnobotany. Terms employed in relation to ethnobotany and its relationship with man and domestic animals. Ethnic – people and their contribution in therapeutic and ethnobotanical knowledge especially with respect to medicinal and allied aspects. Important plants and their folk uses for medicines, food, dyes, tans, etc Methods and tools in Ethnobotanical studies. Ethnobotany of tribals in North India. Traditional Botanical Knowledge- concepts. Ethnobotany of the plants from the following families. Guttiferae (Clusiaceae), Malvaceae, Fabaceae, Mimosaceae, Caesalpinaceae, Combretaceae, Umbelliferae (Apiaceae), Rubiaceae, Asteraceae, Ebenaceae, Apocynaceae, Asclepiadaceae, Euphorbiaceae, Lauraceae, Palmaceae, Poaceae, Liliaceae, Coniferae, Santalaceae, Thymeliaceae. Definition - role of medicinal and aromatic plants in Indian economy - Important essential oil yielding plants in India - Detailed study of Aromatic Plants - lemon grass,

citronella, palmarosa, vetiver, japanese mint, eucalyptus, jasmine, patchouli and geranium - botany, climate and soil requirements, Production Technology, Post Harvest Management and extraction of essential oils. Medicinal plants in India and Uttarakhand - history, origin, area and distribution, production technology, Post Harvest Management extraction of active principles and their uses - uses of different medicinal plants like Atropa, Cinchona, Rauvolfia, Opium, Acorus, Digitalis, Strychnos nux-vomica, Aconitum, Picrorhiza, Chirayita, Neem, Dioscorea, Costus. Cultivation practices of medicinal plants like Adhathoda zylanica, Sida cordifolia, Sterospermum colais, Plumbago zylanica, Tinospora, cordifolia, Kaemferia glanga, Indigofera tinctoria. Trade, Policies and Conservation of Kapoorkachri, Valeriana, Tejpatta, Timur medicinal plants collected in wild.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC117P	Ethnobotany, Medicinal and Aromatic Plants	1	100	-	100

Practical –

Field visit to different tribal regions to gain ethnobotanical knowledge and the inter-relation between plant and people- Survey and identification of plants used by the tribals for medicine, food and other social purposes- Collection and preparation of herbarium specimens of the above plants: cultivation technologies of medicinal and aromatic plants – Propagation techniques – Harvesting and oil extraction of aromatic plants – Field visit, collection and preparation of herbarium – Visiting commercial units of medicinal plants/aromatic plants/Herbal mandis/collection & study of seeds of some medicinal plants and Aromatic Plants.

Suggested Reading:

- Atul, C.K. and Kapur, B.K. 1982. Cultivation and utilization of medicinal plants. RRL., CSIR, Jammu-Tawi.
- Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. Glossary of Indian medicinal plants. CSIR, New Delhi.
- Cunningham, A. 2014. Applied Ethnobotany: “People, Wild Plant Use and Conservation”.
- Taylor & Francis,
- EIRI Board. 2007. Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction
- Ethnobotany. Principles and applications. 1997. C. M. Cotton. John Wiley and Sons Ltd.
- 424p.
- Gunther, E. 1975. The essential oils. Robert, K Krieger Pub. Co., New York.
- Jain, S.K. 2010. Manual of Ethnobotany (2nd Ed). Scientific Publishers, India, 242p.
- Maheshwari, J.K. 2000. Ethnobotany and medicinal plants of Indian subcontinent. Scientific Publishers, Jodhpur, India, 672p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC102T	Nursery Management and Commercial Forestry	2	70	30	100

Theory-

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

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC102P	Nursery Management and Commercial Forestry	1	100	-	100

Practical –

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

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE112T	Tree Seed Technology	2	70	30	100

Theory-

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. 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. 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. Containerised nursery technique - advantages, disadvantages - root deformations - container designs and types/root trainers and rooting media. Conditions/practices affecting survival and early growth, acclimating containerised stock, field handling of containerised stock, planting techniques for containerized stock. Planting bare-root seedlings: advantages, disadvantages. Methods for field handling and planting bare-root stock. Containerised 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.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE112P	Tree Seed Technology	1	100	-	100

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; Study of seed collection and equipments; Planning of seed collection; Seed collection; Seed extraction; Visit to seed production area and seed orchard; Visit to seed processing unit/testing laboratory; Study of seed sampling equipments. 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 tree nurseries.

Suggested Reading

- Agrawal, R.L. 1986. Seed Technology. Oxford - IBH Publishing Co. New Delhi
- 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.
- Bewely, J.D and Black, M. 1985. Seed- Physiology of development and germination
- Bose, T.K; Mitra, S.K. and Sadhu, M.K. 1986 Propagation of tropical and sub tropical Horticultural crops. Naya Prakash, Calcutta
- Chin, H.F. and Roberts, E.H. 1980. Recalcitrant Crop Seeds. Tropical Press Sdn. Bhd. Kuala Lumpur - 22-03, Malaysia
- 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 and Clarendon Press - Oxford. 472p.
- Hartmann, H.T and Kester, D.E. 1968. Plant propagation – principles and practice prentice – Hall of India Private Limited, New Delhi.
- ISTA. 1993. International Rules for Seed Testing Rules. International Seed Testing Association, Zurich, Switzerland, 1993.
- Khullar, P. et. al. 1992. Forest Seed. ICFRE, New Forest, Dehra Dun

- Leadem, C.L. 1984. Quick Tests for Tree Seed Viability. B.C. Ministry of Forests and Lands, Canada.
- 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.
- May, J.T., Belcher, Jr. E. W., Cordell, C.E., Filer, Jr. T.H., David South, and Lantz. C. W. 1985. Southern Pine Nursery Handbook, USDA Forest Service, Southern Region, Cooperative Forestry
- Mehta, A.R and Bhatt, P.N. 1990. Hand book of plant tissue and all cultures. Academic book centre, Ahmedabad
- Napier, I. and Robbins, M. 1989. Forest Seed and Nursery Practice in Nepal. Nepal-UK Forestry Research Project, Kathmandu
- Prakash, R. 1990. Propagation Practices of Important Indian Trees. International Book Distributors, Dehra Dun.
- Schmidt, L. 2000. Guide to Handling Tropical and Subtropical Forest Seed. Danida

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE113T	Rangeland and Livestock Management	2	70	30	100

Theory-

Definition, scope and importance – cattle and fodder resources of India, grassland types of India and their distribution – ecological status of Indian grasslands – principles of grassland management for maximizing forage yield and quality. Feeding habit and grazing behavior of range animals. Carrying capacity – definition, method of calculation. Establishment and management of grasslands – selection of species, planting, cultural practices – liming, fertilizer application, burning, weed control, grazing and cutting intensity. Storage of fodder – silage and hay – methods of preparation – hay banks, Fodder trees and shrubs, Forest grazing. Definition and importance of Livestock management. Important breeds of important livestock eg. Cattle, buffalo, sheep and goat. Breeding and reproductive management for higher productivity. Feeding management – types of feedstuffs available for feeding livestock, methods of feeding. Assessing nutritive value of feed and fodder, estimation of digestible nutrients and energy in feedstuffs. Principles of rationing. Prevention and control of diseases.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE113P	Rangeland and Livestock Management	1	100	-	100

Practical –

Study of grassland and rangelands in the area. Different tools/instruments used in livestock management; Routine management practices followed on livestock farms; Identification of feedstuffs and their nutritive value; Nutritive requirement animals; Study of housing systems and requirements; Preservation of fodder as hay, silage and leaf meal.

Suggested Reading

- Banerjee, G.C. 2010. A text book on Animal Husbandry, 8th Edition, Oxford and IBH New Delhi.
- Holechek J.L. et al. 1989. Range Management. Prentice Hall, New Jersey
- Sastry, N.S.R. and C.K. Thomas. 2005. Livestock Production Management, Kalyani Publishers, New Delhi.
- Singh R.V. 1982. Fodder trees of India. Oxford and IBH New Delhi.
- Ward H.M. 1980. Grasses. A handbook for use in the field and laboratory, Scientific Pub.,
- Jodhpur

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE114T	Forest Tribology & Anthropology	2	70	30	100

Theory-

Meaning, scope and development of Anthropology. Relationships with other disciplines. Main branches of Anthropology, their scope and relevance. Human Evolution and emergence of Man. Phylogenetic status, characteristics and geographical distribution. Principles of Prehistoric Archaeology. Chronology: Relative and Absolute Dating methods. Culture, Society, Marriage, Family, Kinship, Economic and Political Organization, Social Control, Religion, Anthropological theories, Language and Communication, Research Methods in Anthropology. Race and Racism. Applications of Anthropology. Ethno-archaeology in India. Demographic profile of India. The structure and nature of traditional Indian social system. Caste system in India Definition and characteristics of a tribe. Tribes and aborigines- an anthropological perspective. Racial classification and distribution of tribes. Tribes in India and Kerala. Tribal economy. Tribals and Constitution of India Administration of tribal areas in independent India- appraisal of tribal development - problems of tribal identity and integration in the mainstream. Relation between tribes and forests- forest as their immediate environment. Forests as the means of livelihood. Girijan habitat - changes consequent to government control of forests. Forest management and tribal welfare- management conflicts and way forward. Role of forest department in tribal welfare. Role of Non wood Forest products in the economy of tribal's and Tribal cooperative societies. Social forestry and tribal welfare.

Suggested reading:

- Furer-Haimendorf, C.V. 1985. Tribes of India - the struggle for survival. OUP. New Delhi
- Hasnain, N. 2007. Tribal India. New Royal Book Company
- Hasnain, N. 2011. Indian Anthropology. Palaka Prakashan
- Sharma, R.N. and Bakshi, S. 1984. Tribes and tribal development. Uppal Publ. House, New Delhi
- Sharma, R. N., Sharma, R.K. 1997. Anthropology. Atlantic Publishers & Distributors.
- Thakur, D. 1986. Socio-economic development of tribes in India. Deep and Deep Publications,
- New Delhi

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE115P	Study Tour of State Forest*	1	-	-	-

Theory-

Study tour of one week duration in the respective States/part of India. To familiarize the students with the fauna, flora and other research activities research institute, forest industries, Govt. and private organizations of different parts of respective states/ part of India. To expose the students to various national / heritage monuments as part of national integration activity.

* Non credit course

Total Credit to earn in the Semester IV

Core	AECC	SEC	ELECTIVE	TOTAL
12	0	3	6	21

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM
(CBCS)**

SCHEME OF INSTRUCTIONS AND CREDITS

Details Syllabus

Semester-V

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC118T	Climate Science	2	70	30	100

Theory-

Agrometeorology – definition, aim and scope. Factors and elements of weather and climate. Composition and structure of atmosphere. Air and soil temperature regimes, atmospheric humidity, types of clouds and precipitation, hails and frost. Cyclones, anticyclones and thunder storms. Solar radiation components and effect on plant growth. Effect of weather and climate on the growth and development of crops. Climatic normals for crops and trees. Agro climatic zones of India. Evaporation and transpiration.

Climate change: Understanding climate change and its consequences. Global warming and its effects on Forest. Forest and climate change: Vulnerability and adaptability - Evidence of forest disturbance due to climate change –Climate change influence on agro-forestry- Climate resilient forestry. Economic worth of carbon storage in forest – Forest and UN convention on climate change - NATCOM initiatives – Decision making in emission of Green House Gases (GHG). Kyoto protocol, awareness about climate change. National action plan for climate change – Green India mission- Indian Network for Climate Change Assessment (INCCA) - State Action Plans on Climate Change.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC118P	Climate Science	1	100	-	100

Practical –

Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instrument and wind rose. Solar radiation instruments with pyranometer. Layout of an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew. Estimation of green house gases into atmosphere.

Suggested Reading

- Ghadekar, S.R. (2003) Meteorology . Agromet Publishers, Nagpur
- Lenka, D. (1997) Climate, weather and crop in India. Kalyani Publishers, New Delhi
- Mavi, H.S. (1994) Agrometeorology . Oxford & IBH, New Delhi
- Rao, GSLHVP (2003) Agrometeorology, KAU, Thrissur, Kerala,
- Seemann, J., Chirkov, Y.I., Lomas, J., and Primault, B. (2012) Agrometeorology. Springer Berlin Heidelberg

- Varshney, M.C. and Pillai, P.B. (2003) Textbook of Agrometeorology. ICAR , New Delhi.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC119T	Wood Science and Technology	2	70	30	100

Theory-

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

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC119P	Wood Science and Technology	1	100	-	100

Practical –

Mechanical tests on timber. Static bending, impact bending, compression parallel and perpendicular to the grain, hardness, shear, torsion, nail and screw pulling test, brittleness test and calculation of properties. Estimation of combustibility of wood using bomb calorimeter. Estimation of directional shrinkage and swelling of wood. Familiarization of non-destructive wood testing instruments. Visit to wood testing laboratories.

Suggested Reading:

- Bowyer J. L., Shmulsky, R. and Haygreen, J. G. 2007. Forest products and wood science: An introduction. 5th Ed. Blackwell publishing, Ames, IA. 496p.
- Brown, H. P. 1985. Manual of Indian wood technology. International books and periodicals supply service, New Delhi. 121 p.
- FRI. [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute, Dehradun. 941p.
- Panshin, A. J. and De Zeeuw, C. 1980. Textbook of wood technology, 4th Ed. McGraw-Hill. New York, USA: 722p.
- USDA [U.S. Department of Agriculture]. Wood handbook - Wood as an engineered material. 1999. U.S. Department of Agriculture, Forest Service. Forest Products Laboratory, Madison, WI. 508p.

--

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC120T	Logging and Ergonomics	2	70	30	100

Theory-

Definition and scope of logging, logging plan and execution. Location and demarcation of the area for logging and estimation of produce available for extraction. Implements used in logging operation; traditional and improved tools. Felling rules and methods, Work contracts related to felling and removing (contract system, convener systems) etc. Conversion, measurement and description of converted material. Means of transport of timber; carts, dragging, skidding, overhead transport, ropeways, skylines. Transport by road and railways. Transport by water; floating, rafting and concept of booms. Non-destructive sampling methods of wood. Grading and storage of timber in the depots for display and disposal, temporary and final storage. Timber Depots; types, lay out and management. Systems of disposal of timber. Ergonomics: definition, components and provision of energy. Requirement of energy and rest periods. Effect of heavy work, posture, weather and nutrition. Personal protective equipments, safety helmets, ear and eye protections. Accidents: causes, statistics, safety rules and first aids.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC120P	Logging and Ergonomics	1	100	-	100

Practical –

Equipments and tools used in logging operations and their uses. Instructions regarding maintenance of various records and registers in logging operations; Conversion of felled trees into logs, poles, firewood, pulpwood. Visit to local saw mills to study the equipments used and process of conversion. Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers. Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites. Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes. Stacking and stock checking of different logs, poles and firewood in the depots so as to confirm that all the converted materials in the forests have reached their destination. Stacking of the lots for display and final disposal; recording of the lots for auction sale. Final disposal of the material. Visit during the auction sale in the government timber depots; Preparation of ergonomic check lists. Familiarize the e-auctioning procedure of State Forest Department. Safety rules and first aids in forestry operations

Suggested Reading

- Brown, N. C. 2002. Principles and methods of harvesting of timber. Biotech books, Delhi.
- 430p.
- Staaf, K.A.G. and Wiksten, N.A. (1984). Tree Harvesting Techniques. Martinus Nijhoff/DR
- W. Junk Publishers, Netherlands.
- FRI. [Forest Research Institute]. 1976. Indian forest utilization. Volume I and II. Forest Research Institute and colleges, Dehradun. 941p.
- GFC. [Guyana Forestry Commission]. 2002. Code of practice for timber harvest. 2nd Ed.

- Georgetown, Guayana. 42p.
- Hakkila, P. 1989. Utilization of residual forest biomass. Springer-verlag, Berlin. 567p.
- Jones, J. T. 1993. A guide to logging aesthetics. Northeast Regional Agricultural Engineering Service, Ithaca, New York. 36p.
- Jones, J. T. 1993. A guide to logging aesthetics. Northeast Regional Agricultural Engineering Service, Ithaca, New York. 36p.
- Mehta, T. 1981. A handbook of forest utilization. IBD Dehradun. 298p.
- Wakermann, A. E. 2002. Harvesting timber crops. Biotech books, Delhi. 433p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC121P	Experimental Learning - I	5	100	-	100

Practical -

- Production and Marketing of high value forest produce (0+5) (FP)
- Raising Quality Planting Materials for forest regeneration (0+5) (SA/FB)
- Apiculture/Sericulture (0+5) (FB/NR/WL)
- Ecotourism (0+5) (BS/WL)
- Wild Animal Health Management (0+5) –WL

(1) Production and Marketing of high value forest produce 5(0 + 5)

Project formulation, Market survey and prioritization of species. The species (imported and indigenous) that are currently available in the market has to be surveyed through personal visits to timber markets, saw mills, forest depots etc. Lesser known, but highly utilizable indigenous species of timbers will be given priority. Fast rotation timber species raised under various trials of the University will also be included to the extent possible.

Potential of different species for various end uses will be determined. Timber samples have to be converted into sticks / smaller sizes / macerated through appropriate procedures such as sawing and sizing in a saw mill or maceration in a laboratory. Mechanical tests: Static bending, compressive tests-across and along the grain. Finding out safe working stresses of lesser known or exotic/new species. Wood database currently available in the department will be updated based on the test results. Project report preparation and presentation, final examination. Wood conversion in an integrated saw mill, turnery for handicrafts, joineries and furniture making. Data analysis, project report writing, presentation and final examination.

(2) Raising Quality Planting Materials for forest regeneration 5(0+5)

Project for mulation, Identification of species (grasses, trees, medicinal plants & wild fruits) for nursery raising, time of collection of plant material from selected seed sources, quantity of seed/plant material required, nursery area (open and protected), inputs required, Schedule for intercultural operation-seed treatment, sowing, weeding, fertigation, root hardening treatments. Assessment of demand in local/potential markets and institutions. Collection, Handling, Processing and Storage of planting material. Identification of superior seed sources, seed collection, treatment and storage. Vegetative propagati on under controlled and ambient conditions. Collection of vegetative propagules. Treatment and processing of bare root and containerized seedlings. Project Report and Presentation, Final examination

(3) Apiculture 5(0+5)

Project for mulation, Apiculture-Scope and importance of beekeeping–Bees classification– Hives –Social organization–extraction of honey and other products. Marketing of honey and bee wax and their value addition. Cost Benefit analysis, Project Report and Presentation, Final examination.

(4) Ecotourism 5(0+5)

Socio- economic feasibility analysis for initiating ecotourism projects. Tour planning and site development. Social engineering and natural resource management. Study of environmental and social impacts of ecotourism and mitigation strategies. Potential of ecotourism as a business.

(5) Wild Animal Health Management 5(0+5)

Basic concepts of disease and health conditions. Review of major diseases of Indian wild mammals, birds, amphibians and reptiles. Epidemiology of disease. Disease and population dynamics. Disease transmission between domestic and wild populations. Malnutrition, starvation, dehydration as disease syndromes. Condition, health and nutritional assessment in free-ranging populations. Control of disease planning and management of wildlife health programmes. Zoonoses.

Skill Enhancement Course (SEC)

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC103T	Entrepreneurship Development & Business Management	1	70	30	100

Theory-

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/ SSI. Export and Import Policies relevant to forestry sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of forestry inputs industry. Characteristics of Indian forestry processing and export industry. Social Responsibility of Business.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	

SOA/FSEC103P	Entrepreneurship Development & Business Management	1	100	-	100
<p>Practical –</p> <p>SWOT analysis, developing leadership skills, developing managerial skills, problem solving skill, supply chain management and total quality management, project planning formulation and report preparation.</p> <p>Suggested Reading:</p> <ul style="list-style-type: none"> • Maslow, A.H 1970 Motivation and personality. Harper and Row publishers , New York. • Perelson, B and Steiner, G 1964 Human behaviour. Harcourt Brace Jovanovich , New York. 					

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE116T	Forest Hydrology and Watershed Management	1	70	30	100
<p>Theory-</p> <p>Importance and scope of Hydrology. Definitions. Hydrological cycle. Energy and water balance equations precipitation- rain and snow hydrology. Interception, infiltration, evaporation and transpiration- paired water sheds, surface water, run off processes and hydrograph. Soil water energy concept, movement, availability and measurement. Watershed management- an approach for sustainable productivity-principles and practices- Methods for water conservation- water harvesting techniques. Role of trees in water conservation- natural terracing- species suitability- Recharging of water springs. Forest treatment and water yield. Application of GIS in watershed delineation.</p>					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE116P	Forest Hydrology and Watershed Management	1	100	-	100
<p>Practical –</p> <p>Study of hydrological equipment; Measurement and analysis of rainfall data; Estimation of runoff using rational formula; Preparation, use and analysis of hydrograph; Measurement of evaporation by different methods; Visit to forest watersheds to study the effect of forest treatment on hydrological properties. Assessment of the impact of watershed treatments such as afforestation/restocking, assisted regeneration etc. on the watershed functioning- field layout- regeneration assessment- interpretation of results.</p>					

Suggested Reading

- Bennet, H. H. 1965. Elements of Soil conservation. Mc Graw Hill Book Co. Inc. New York
- 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
- Hamilton L. S. 1983. Tropical Forested Watersheds: hydrologic and soils response to major uses or conversions. International Book Distributors, Dehra Dun
- Hamilton, L.S. (ed.). 1983. Forest and Watershed Development and Conservation in Asia and the Pacific. International Book Distributors, Dehra Dun
- Hewlett, JD and Nutter, WL 1969. An Outline of Forest Hydrology. University of Georgia Press, Athens 132p
- Hudson, N. 1981. Soil Conservation. BT Batsford Limited, London 324 p.
- Lal R. 2000. Integrated Watershed Management in the Global Ecosystem. CRC Press, London

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE117T	Forest Economics and Marketing	1	70	30	100

Theory-

Economics- meaning, definition, subject matter. Divisions of economics. Importance of economics- Forest Economics- meaning, definition. Basic concepts-Goods, service, utility, value, price, wealth, welfare-Wants-Meaning, characteristics, classifications of wants, importance. Theory of consumption- law of diminishing marginal utility, meaning, definition, assumption, illustration, limitations, law of equi-marginal utility. Importance. Consumer surplus-meaning, definition, importance. Demand-meaning, definition, kinds of demand, demand schedule, demand curve, law of demand, extension and contraction vs increase and decrease in demand. Elasticity of demand-types of elasticity of demand, degrees of price elasticity of demand, methods of measuring elasticity, factors in influencing demand, elasticity of demand, importance of elasticity of demand-supply- meaning, supply function-law of supply-factors in influencing supply-pricing of timber and non-timber products-Economics of timber and non-timber forest products. Forest planning-forest policy and development. Production-meaning, factors of production-land, labour, capital, organization, entrepreneurship-Distribution-rent, wages, interest, profit-National Income-definition and concepts-.Public finance-meaning- Public resource-meaning- sources. Taxation-types. Public expenditure-meaning, principles. Money-meaning-evolution-Inflation. definition, types of inflation. Welfare economics-meaning and basic concepts.

Marketing- definition, Marketing Process – Need for marketing, Role of marketing, Marketing functions, Classification of markets Marketing of various channels, Price spread, Marketing Efficiency, Integration, Constraints in marketing of agricultural produce. Market intelligence, Basic guidelines for preparation of project reports Bank norms – Insurance – SWOT analysis – Crisis management.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE117P	Forest Economics and Marketing	1	100	-	100

Practical –

Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Identification of marketing channel– Calculation of price Spread, Identification of Market Structure – Visit to different Markets.

Suggested Readings

- Dewett, K. K. 2005. Modern Economic Theory. S. Chand, New Delhi.
- Dewett, K. K., Verma. 2004 Elementary Economic Theory, S. Chand, New Delhi
- Jhingan, M. L. 2012. Macro Economic Theory. Vrindapublishers, New Delhi.
- Reddy, S.S., Raghu Ram, P., Neelakanta Sastry, T.V., Bhavani, D.I. 2004. Agricultural Economics. Oxford and IBH Publishers, New Delhi.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE118T	Forest Extension & Community Forestry	1	70	30	100

Theory-

Forest Extension: Introduction- human behaviour and psychology. Concept, scope, principles, philosophy and objectives of extension education and forestry extension education. Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and types of education, Formal, informal non-formal education. People's participation in Forestry programmes. Elements of extension education, man himself man's environment and man's created devices. Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) Krishi Vigyan Kendras (KVK), Van Vigyan Kendras, Technology Assessment and Refinement Programme (TARP) of ICAR/ ICFRE. Communication: meaning, definition, elements and selected models. Audio-visual aids: importance, classification and selection. Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA). Rural social groups, primary and secondary groups, formal, informal group, temporary, permanent groups, references group, classification of group.

Community Forestry: Legislation, rules, importance. Case studies of JFM, FDA, JICCA, CAMPA, Haryali Yojana, Integrated Watershed Management implementation- problems and prospects, Microplan Preparation. JFMs, FDCs, VFCs, CBOs, NGOs and co-operative societies.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE118P	Forest Extension & Community Forestry	1	100	-	100

Practical –

Visits to study structure, functions, linkages and extension programmers of KVKs or ICFRE institutes/voluntary organizations/Mahila Mandal/Village Panchayat/Van Panchayat/ State Forest Department (Social forestry wing). Group discussion at farm homesteads. Preparing individual and village level production plans. Preparation of charts, posters and flash cards. Participation in conducting exhibitions and method demonstrations/campaigns at the village level. Familiarization of the use of audio-visual aids. PRA exercises. Visit to village to study the community forestry components- Community reserve, organizational set up and administrative procedures in a social forestry (SF) Range, Microplan preparation-Field visit to a JFM operational area and conduct PRA surveys. Afforestation techniques and social forestry.

Suggested Reading:

- FAO (1984). Forestry extension, making it work, An international journal of forestry and forest industries, Unasylva - No. 143, Published by FAO.

- L.K. Jha and P. K. Sen Sarma, A.P.H. (2008). A Manual of Forestry Extension Education, Published by VEDAMS, P. 386p.
- D. Sim, H. A. Hilmi (1987), Forestry Extension Methods, FAO Forestry Paper-80, P. 153.
- Jalihal, K.A. Veerabhadraiah, V. (2007), Fundamentals of Extension Education and Management in Extension, Concept Publishing Company.
- Balakathiresan, S. (1986). Essentials of forest management, Nataraj Publishers, Dehradun.
- Bullock, R. C. L. and Hanna, K.S. (2012). Community Forestry Local Values, Conflict and Forest Governance. Cambridge University Press.
- Gunter, J. (Ed.). (1973). The Community Forestry Guidebook (http://www.forrex.org/sites/default/files/forrex_series/FS15.pdf).
- Ojha, H.R., Timsina, N.P., Kumar, C., Banjade, M.R and Belcher, B. (2007). Communities, Forests and Governance: Policy and Institutional Innovations from Nepal. Adroit Publishers, New Delhi, India.
- Roy, S.B. and Chatterjee, M. (1994). Joint Forest Management. Inter India Publications
- Tiwari, K.M. (1983). Social forestry for rural development. International Book Distributors.
- Vyas, G. P.D. (2006). Community Forestry. Agrobios, India.

Total Credit to earn in the Semester V

Core	AECC	SEC	ELECTIVE	TOTAL
14	0	2	6	22

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semester] CHOICE BASED CREDIT SYSTEM
(CBCS)
SCHEME OF INSTRUCTIONS AND CREDITS
Details Syllabus
Semester-VI**

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC122T	Forest Laws, Legislation and Policies	2	70	30	100

Theory-

National forest policies-scope and importance- comparative analysis of all forest policies -Indian judicial system- Legal definitions, application of penal code to forests, general principles of criminal law, legal principles of punishment, criminal procedure code, the law of evidence and the Indian Evidence Act, 1872 as applied to forestry matters. Indian Forest Act, 1927 general provisions, Code of Civil procedure, 1908. Forest (Conservation) Act, 1980. Brief description about other major forest laws of regional, national and international significance. Detailed study of KFA 1961. Biological Diversity Act, Van Panchayat Policy, Uttarakhand Forest Policy, Court verdicts on issues of utmost importance to conservation.

Suggested Readings

- 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.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC123T	Geomatics	2	70	30	100

Theory-

Remote sensing - classification based on source: active and passive remote sensing; aerial and space remote sensing; interaction of electromagnetic radiation with atmosphere and earth surface, Aerial photographs – types; photo interpretation, Satellite remote sensing - platforms and sensors; satellite systems. Indian Remote Sensing Programme; visual and digital image processing; application of satellite based remote sensing techniques in forestry - vegetation mapping using satellite imagery-NDVI; Forest cover monitoring and damage assessment, Microwave remote sensing. Introduction to GIS. Differences between GIS and conventional cartography. Spatial and non-spatial data, Integration of attribute data with spatial data. Spatial data - Raster and Vector data-Thematic overlays in GIS- topology building and calculation of area and length etc. Application of GIS in forestry – using imageries and integration with GIS data. Maps-its projection-Toposheet and Map reading, Global Positioning System (GPS) applications in resource inventory, Global Navigation Satellite System, Galileo, GLONASS, QZSS, Compass, IRNSS etc., GAGAN, Brief study of GIS software ARC GIS, ARC MAP,ARC INFO, ERDAS, GEOMEDIA, Q-GIS.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC123P	Geomatics	1	100	-	100

Practical –

Preparation maps; visual interpretation of satellite imagery; forest cover mapping and land use mapping. Digital image processing. Introduction to various GIS software – Q-GIS, ERDAS, Arc GIS etc. Exercises in viewing, editing, overlay. Visit to the GIS labs at State level.

Suggested Reading

- Campbell, J.B. (2002). Introduction to Remote Sensing-Third edition. Taylor and Francis, London
- Environment System Research Institute, (1999). GIS for Everyone. Redlands, CA:ESRI
- Jackson, M.J. (1992). Integrated Geographical Information Systems. International Journal of Remote Sensing, 13(6-7): 1343-1351
- Joseph, G. (2005). Fundamentals of Remote Sensing-Second edition. Universities Press
- Lillesand, T.M. and Kiefer, W.R.(1994).Remote sensing and Image Interpretation, Fourth edition. John Wiley & Sons, Inc., USA
- Obi Reddy, G.P. and Sarkar, D. (2012). RS and GIS in Digital Terrain Analysis and Soil Landscape Modelling. NBSS & LUP,Nagpur.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC124T	Restoration Ecology	2	70	30	100

Theory-

Degraded lands: concept, classification, status, extent and causes of degradation/ wastelands. Different types of degraded lands – physical, chemical and biological land degradation. Soil erosion- types, causes and mechanism, measures to control erosion, ravine and sand dune formation and their control measures. Salt affected soils- classes of salt affected soils, causes, extent and their effects on plant growth and afforestation / reclamation practices. Acid soils- definition, characteristics, causes and afforestation. Water logged areas- explanation, impact on plant growth and bio-drainage techniques. Afforestation and reclamation of denuded hill slopes, land slips and landslides, avalanche and

cold desert, mined out, dry, rocky and murramy areas. Desertification- definition, impact and causes, prevention and counter measures (shelter belts and wind breaks). Soil pollution- types, effects and control measures through forestry techniques. National and state level programmes on degraded lands/wasteland development. Role of Government agencies and NGO's in degraded lands/wasteland development programme.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC124P	Restoration Ecology	1	100	-	100

Practical –

Selection criteria tree species suitable for different degraded lands. 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 murramy areas) and afforestation programme. Preparation restoration plan for a piece of degraded land.

Suggested Reading:

- Anilkumar and Pandey, RN 1989. Wastelands Management in India. Ashish Publishing House, New Delhi
- Buol, S.W., Kole, F.D. and McGracken, R.J. 1975. Soil Genesis and Classification. Oxford and IBH Publ. New Delhi.
- Butler, B.E. 1980. Soil Classification for Soil Survey. Clerneder Press-Oxford Publ. Co., London.
- Gregersen, H. Draper, S. and Elz. D.(eds.) 1989. People and Trees- The Role of Social Forestry in Sustainable Development EDI Seminar Series, The World Bank, Washington, D.C. 273p
- Hegde NG 1987. Handbook of Wasteland Development. BAIF, Pune 102p.
- Hegde NG and Abhyankar 1986 (eds). The Greening of Wastelands. BAIF, Pune 204p
- IARI 1960. Soil Survey Manuel, IARI. New Delhi.
- ICAR 1977. Desertification and its Control. ICAR, New Delhi 358p.
- National Commission on Agriculture 1976. Report of the National Commission on Agriculture, Part ix,
- Prasad, V. N. 1985. Principles and Practices of Social-Cum-Community Forestry. International Book Distributors, Dehradun, 108p
- Shah, S. A. 1988. Forestry for People. ICAR, New Delhi, 147p
- Sharma, S. C., Chaturvedi R. B and Mishra O. P 1990. Utilization of Wastelands for Sustainable Development In India. Concept Publishing Co. New Delhi-59, 488p
- Production and Marketing of high value forest produce (0+5) (FP)
- Raising Quality Planting Materials for forest regeneration (0+5) (SA/FB)
- Apiculture/Sericulture (0+5) (FB/NR/WL)
- Ecotourism (0+5) (BS/WL)
- Wild Animal Health Management (0+5) – WL

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC125P	Experiential Learning-II	5	100	-	100

Practical -

(1) Production and Marketing of High Value Forest Produce 5(0+5)

Project formulation, Market survey and prioritization of species. The species (imported and indigenous) that are currently available in the market has to be surveyed through personal visits to timber markets, saw mills, forest depots etc. Lesser known, but highly utilizable indigenous species of timbers will be given priority. Fast rotation timber species raised under various trials of the University will also be included to the extent possible.

Potential of different species for various end uses will be determined. Timber samples have to be converted into sticks / smaller sizes / macerated through appropriate procedures such as sawing and sizing in a saw mill or maceration in a laboratory. Mechanical tests: Static bending, compressive tests-across and along the grain. Finding out safe working stresses of lesser known or exotic/new species. Wood database currently available in the department will be updated based on the test results. Project report preparation and presentation, final examination. Wood conversion in an integrated saw mill, turnery for handicrafts, joineries and furniture making. Data analysis, project report writing, presentation and final examination.

(2) Raising Quality Planting Materials for Forest Regeneration 5(0+5)

Project for mulation, Identification of species (grasses, trees, medicinal plants & wild fruits) for nursery raising, time of collection of plant material from selected seed sources, quantity of seed/plant material required, nursery area (open and protected), inputs required, Schedule for intercultural operation-seed treatment, sowing, weeding, fertigation, root hardening treatments. Assessment of demand in local/potential markets and institutions. Collection, Handling, Processing and Storage of planting material. Identification of superior seed sources, seed collection, treatment and storage. Vegetative propagation under controlled and ambient conditions. Collection of vegetative propagules. Treatment and processing of bare root and containerized seed lings. Project Report and Presentation, Final examination.

(3) Apiculture 5(0+5)

Project for mulation, Apiculture-Scope and importance of beekeeping-Bees classification- Hives-Social organization-extraction of honey and other products. Marketing of honey and bee wax and their value addition. Cost Benefit analysis, Project Report and Presentation, Final examination.

(4) Ecotourism 5(0+5)

Socio- economic feasibility analysis for initiating ecotourism projects. Tour planning and site development. Social engineering and natural resource management. Study of environmental and social impacts of ecotourism and mitigation strategies. Potential of ecotourism as a business.

(5) Wild Animal Health Management 5(0+5)

Basic concepts of disease and health conditions. Review of major diseases of Indian wild mammals, birds, amphibians and reptiles. Epidemiology of disease. Disease and population dynamics. Disease transmission between domestic and wild populations. Malnutrition, starvation, dehydration as disease syndromes. Condition, health and nutritional assessment in free-ranging populations. Control of disease planning and management of wildlife health programmes. Zoonoses.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC104T	Plantation Forestry	2	70	30	100

Theory-

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-project appraisal and project implementation- feasibility studies. Plantation silviculture - Choice of species, plantation establishment-plantation maintenance- nutrition in plantations, use of fertilizers, major pest and disease in plantations, sanitation and control measures. Dynamics of stand growth- CCF-MCA- stand density management in plantations- thinning regimes- improvement fellings. Site quality evaluation, stand basal area- site index concept in plantation forestry-plantation productivity assessment- growing stock assessment- MAI, sustainability of plantations. Plantation records-plantation journal. 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. Economic factors in plantation development- social and cultural considerations.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC104P	Plantation Forestry	1	100	-	100

Practical –

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. Study of planting operations- study of tending techniques- Planting methods and techniques for different types of plantations including energy plantations, canal bank plantations - pulp wood plantations- study of Forest Development Corporation plantations- road side plantations plantation planning- Plantation journal- Choice of species for plantations- economic considerations in plantation. Study of govt vs. pvt. Plantations.

Suggested Reading

- Bowen, G.D., E. K. S. Nambiar, E.K.S 1984. Nutrition on Plantation Forests. Academic Press, 1984 -Nature - 516 pages
- 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, 467p.
- Krishnapillay.B. 2000. Silviculture and Management of teak plantations. Unasylva. 201. Vol 51. 14-21p
- 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. 571p.
- Nambiar, E.K.S., Cossalter, C and Tiarks.A. 1998. Site Management and Productivity in Tropical Plantation Forests. Workshop Proceedings, South Africa.
- Suzuki, K., Ishii, K., Sakurai, S. and Sasaki, S. 2006. Plantation Forestry in the Tropics. Springer Tokyo.

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE119T	Non-Timber Forest Products, Marketing & Trade	1	70	30	100

Theory-

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. Economic features of specialized markets in terms of degree and type of competition for bamboo, canes, lac, gums, resins, hides and skins. Essential oil, Seed oil, fibers, Hosses, Tans dyes wild edible nuts, pulp & paper. Economics of gathering medicinal plants from forests, economics of processing medicinal plants. Domestic demand and trade in timber and non-timber forest products. International demand and trade in timber and non-timber forest produce. 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. 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) and timber certification.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE119P	Non-Timber Forest Products, Marketing & Trade	1	100	-	100

Practical –

Library review of studies on marketing and trade of timber forest produce (teak, sal, rosewood, *Terminalia* spp. *Pterocarpus* and other important timber of national importance etc.); Non- Timber Forest Produce (NTFP such as bamboo, canes etc.); forest based medicinal and aromatic plants. Visits to timber produce and NTFP markets to collect price data and quantity sold and to observe auctions and competitions. Analysis of price and quantitative data of timber forest produce, NTFP for examining trend; seasonal, cyclical variations. Visit to markets of forest based medicinal plants. Study of buy back arrangements in forest based medicinal plants trade. Valuation of timber and NTFP (existence value, use and option values, intrinsic value etc). Development of hypotheses to study the marketing of forest produce. Presentation of results on analysis of price and quantity. Economics of processing pulp to paper/poly fiber; wood to plywood/veneers.

Suggested Reading

- Gray, J. W. 1993. Forest resource systems in developing countries. Food and agricultural organization. Rome. 259p.
- 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. 330p.
- ITTO. [International Tropical Timber Organisation]. 2012. Annual review and assessment of the world timber situation, Yogyakarta, Indonesia. 182p.
- Kula, E. 1996. The economics of forestry: Modern theory and practice. Timber press, Portland, Oregon. 182p.
- 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. 177p
- Tewari, D. N. 1995. Marketing and trade of forest produce; International Book Distributors (Book Sellers & Publishers), Dehradun, India. 140p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE120T	Certification of Forest Products	2	70	30	100

Theory-

Definition of forest certification. Responsible sourcing of wood. Principal stages in the process of certification. Producer's motivation for supplying certified forest products. Key aspects of certification. Principles of sustainable forest management. Origin of certification. Organizations responsible. Legislations and policies of importance. 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. International trade in tropical logs and sawn wood. Pros and cons of certification. Potential for certifying forests and forest products of India. Tracing illegal logging. Identification of species and region of origin. Timber tracing through genetic methods and (analysis of stable isotope ratios).

- 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. 30p. Details available at: <http://www.giz.de/Themen/de/dokumente/en-d28-inenpenent-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. 153p.
- Conroy, M. E. 2007. Branded! How the "certification revolution" is transforming global corporations. New Society publishers, Gabriola Island, BC. 354p.
- Gupta, H. S., Yadav, M., Sharma, D. K. and Singh, A. M. 2013. Ensuring sustainability in forestry: certification of forests. TERI, New Delhi. 284p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE121T	Recreation and Urban Forestry	1	70	30	100

Theory-

Forest recreation – definition and scope, social and environmental aspects of recreation, components, new approaches in forest recreation. Principles and elements of landscaping -types of landscape designs formal-Persian and Mughal designs, and informal- British and Japanese. Landscape components- plant and other components- lawn, pergolas, hedges, edges, topiary, baloon, arbours, carpet beds, trees, flower beds, annuals, and climbers. Practices of landscaping- Tools and implements for landscaping. Specialised 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. Urban forestry – definition and scope – uses of urban forests, Management of urban forest-Arboriculture and its importance in urban forestry. Impact of urban forestry. Species suitable for urban forests, criteria of suitability.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE121P	Recreation and Urban Forestry	1	100	-	100

Practical –

Preparation, planning and designing the planting pattern for parks, sanctuaries, industrial complexes and avenues in cities – familiarise with the components of landscaping – studies on the features of flowering and foliage trees suitable for avenue planting – visit to landscaped areas, parks tourist spots and centres, national parks and sanctuaries., practice planting methods.

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.
- 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.

Total Credit to earn in the Semester VI

Core	AECC	SEC	ELECTIVE	TOTAL
13	0	3	6	22

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semesters] CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF INSTRUCTIONS AND CREDITS
Details Syllabus
Semester-VII**

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC126T	Forest Inventory and Yield Prediction	1	70	30	100
<p>Theory- Yield - in regular forests-in Irregular forests. Estimation of growth and Yield of stands, Forest Inventory, Point sampling. Forest Inventory - definition-objectives- Kinds of enumeration- tree assessment techniques. Measurement of wood volume, tree volume & tree volume tables. Kinds of sampling, Sampling design. Kinds of sampling units- fixed area and point sampling units, Plots, strips, topographical units - sampling intensity, Inventory designs used in India, Sampling errors and non-sampling errors. Organization of field work and conduct of enumeration, Point sampling- concept of horizontal point sampling. Estimation of growth and yield prediction in forest stands- stand structure - growth of stand. Methods of predicting future growth of stands - stand density -canopy density, Crown competition factor. Yield tables- definition, Preparation of yield table, application and use of yield tables, stand table-definition and use.</p>					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC126P	Forest Inventory and Yield Prediction	1	100	-	100

Practical –

Study the demarcation and alignment of plots, strips etc. Field exercise on horizontal field demonstration of various sampling techniques- simple, stratified, multi stage, multiphase, non- random sampling techniques. Visit forest areas for forest enumerations- point sampling- use of wedge prism and Relaskop - Field exercise on the determination of site quality -Visit to local forest divisions and study the methods of preparation and use of yield tables. Method/demonstration on the use of aerial photographs in forest inventory

Suggested Readings:

- Chapman, H.H and Meyer, W.H. (2008). Manual of Forest Mensuration: Methods and Techniques. Asiatic Publishing House, New Delhi, 522p.
- Chaturvedi, A.N and L.S. Khanna. (2011). Forest Mensuration and Biometry (5th edition). Khanna Bandhu. Dehra Dun. 364 pp.
- Heindjik, D. (1975). Forest Assessment. International Book Distributors, Dehradun, 349p
- Husch, B., Beers, T.W. and Kershaw, Jr. J.A. (2002). Forest Mensuration (4th edition). John Wiley & Sons, Nature.456 pp.
- Kangas, A. and Maltamo, M. (2006). Forest Inventory: Methodology and Applications.
- Managing Forest Ecosystems (Vol.10). Springer.340pp.
- Philip, M.S. (1994). Measuring Trees and Forest. AB International, UK,310p
- Scott, C.T and Gove, J.H. (2002). Forest Inventory. Encyclopedia of Environmetrics (Vol2), John Wiley & Sons. pp814–820
- Shiver, B.D and Borders, B.E. (1996). Sampling Techniques for Forest Resource Inventory. John Wiley and Sons, New York, 356p
- Spurr, H.S. (1952). Forest Inventory. John Wiley and Sons, New York, 476p.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC127T	Forest Biotechnology	2	70	30	100
Theory-					

Concepts and history of plant biotechnology: scope and importance in tree improvement: Totipotency and morphogenesis, nutritional requirements of in-vitro cultures; techniques of in- vitro cultures, micro propagation, anther culture, pollen culture, ovule culture, embryo culture, test tube fertilization, endosperm culture, factors affecting above in-vitro culture, Applications and Achievements, somaclonal variation-types, reasons: Somatic embryogenesis and synthetic seed production technology, Protoplast isolation, culture, manipulation and fusion; Products of somatic hybrids and cybrids. Applications in tree improvement. Genetic engineering, Restriction enzymes, Vectors for gene transfer – gene cloning, Direct and indirect method of gene transfer. Transgenic plants, their applications, achievements and biosafety regulations, Blotting techniques – DNA finger printing and bar coding, DNA based markers – RFLP, AFLP, RAPD, SSR, VNTRS, CAPS, SNPs, ESTs and DNA probes – mapping QTL – future prospects. MAS, and its application in tree improvement.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC127P	Forest Biotechnology	1	100	-	100

Practical –

Requirements for plant tissue culture laboratory. Techniques in plant tissue culture; media components and preparations; sterilization techniques and inoculation of various explants; aseptic manipulation of various explants; callus induction and plant regeneration, Micro propagation of important crops-anther, embryo and endosperm culture. Hardening / Acclimatization of regenerated plants. Somatic embryogenesis and synthetic seed production. Isolation of protoplast; Acclimatization of culturing of protoplast. Demonstration of Isolation of DNA. Demonstration of gene transfer techniques, direct methods. Demonstration of confirmation of genetic transformation. Demonstration of gel-electrophoresis technique

Suggested Reading:

- Bajaj, Y.P.S. (Ed) (1988). Biotechnology in Agriculture and Forestry 2. Crops 1. Springer- Verlag, Berlin.
- Dhawan, V (2012) Applications of Biotechnology in Forestry and Horticulture. Springer US
- Guptha, P.K. (2000). Elements of Biotechnology. Rastogi publications, Meerut.
- Neumann, K.H., Kumar, A., and Sopory, S.K. (2008) Recent Advances in Plant Biotechnology and Its Applications. I. K. International Pvt Ltd
- Punia, M.S. (1998). Plant Biotechnology and Molecular Biology. A laboratory manual. Scientific Publishers, Jodhpur
- Thieman, W.J. and Palladino, M.A. (2009). Introduction to Biotechnology, Second Edition. Pearson Benjamin Cummings, San Fransis.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC128T	Agroforestry Systems and Management	2	70	30	100

Theory-

Land use and land capability classification- overview of agroforestry around the world – agroforestry systems in India. Classification of agroforestry systems – structural, functional, agroecological, socio-economic and physiognomic basis. Agrosilvicultural systems – improved fallows in shifting cultivation – soil dynamics in shifting cultivation, taungya systems, Alley cropping –structural and functional attributes. Multipurpose trees and shrubs on farmlands, agricultural fields, plantation crop combinations- commercial crops under shade of planted trees and natural forests- Windbreaks & Shelterbelts. Silvopastoral systems – protein banks, live fence offodder trees and hedges, trees and shrubs in pastures. Pastoral silviculture systems- grassland and tree management in the humid, arid and semi- arid regions. Agrosilvopastoral systems – tropical home gardens –structural and functional attribute. Other systems – apiculture, sericulture and mixed woodlots. Major Agroforestry practices in different agroecological zones of India- arid and semi-arid regions- agroforestry practices for wasteland reclamation. Agroforestry practices for salt affected soils, agroforestry practices for wetlands and waterlogged areas. Non-wood forest products based agroforestry. Soil fertility improvement and water conservation through agroforestry. Socio-economic analysis of various agroforestry systems. Diagnosis and design of Agroforestry.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC128P	Agroforestry Systems and Management	1	100	-	100

Practical –

Study the desirable characteristics of trees/shrubs/grasses for various agroforestry programmes. Assessment of standing stock of tree species in various agroforestry systems such as homegardens. Survey of agroforestry practices in local/adjoining areas. Field observations to characterize the structural, functional and economic attributes of the following agroforestry systems and practices- agrosilviculture systems, silvopastoral systems, pastoral silviculture systems, agrosilvopastoral systems, shelterbelts and windbreaks, live fences; fodder trees and protein banks. Exercise on diagnosis and design of agroforestry systems and practices. Assessment of productivity of tree crop combinations. Studying resource partitioning in agroforestry systems - water, light and nutrients. Analysis of soil and plant samples for water holding capacity, organic carbon N, P and K.

Suggested Reading:

- Huxley, PA 1983 (ed). *Plant Research and Agroforestry*, ICRAF, Nairobi, Kenya.
- Huxley, P. 1999. *Tropical Agroforestry*. Wiley: 384p.
- Kumar, B. and Nair, P.K.R. (eds). 2006. *Tropical Homegardens: A Time-Tested Example of Sustainable Agroforestry*. Volume 3 in the Book Series “Advances in Agroforestry”. Springer Science, the Netherlands
- Kumar, B.M. 2011. Species richness and aboveground carbon stocks in the homegardens of central Kerala, India. *Agriculture, Ecosystems and Environment*. 140: 430–440
- Kumar, B.M. and Nair, P.K.R. 2004. The enigma of tropical homegardens. 2004. *Agroforestry Systems*. 61: 135–152.
- 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
- Michael P. 1984. *Ecological Methods for Field and Laboratory Investigations*. Tata McGraw-Hill Pub. Co. New Delhi.
- Mohan, S., Nair, P.K.R., Long, A.J. 2007. An Assessment of Ecological Diversity in Homegardens: A Case Study from Kerala State, India. *Journal of Sustainable Agriculture*. Volume 29, Issue 4: 135-153.
- Nair, P.K.R, Rao MR, and Buck LE (eds), 2004. *New Vistas in Agroforestry: A Compendium for the 1st World Congress of Agroforestry*, Kluwer, Dordrecht, The Netherlands.
- Nair, PKR 1993. *An Introduction to Agroforestry*. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- 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.

Skill Enhancement Course (SEC)

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC105P	Industrial Placement (20 days)	4	100	-	100

Practical –

Attachment with Forest Based Industries like Wood Workshop, Saw Mills, Wood Seasoning and Preservation Treatment Plants, Pulp and Paper Industries, Aromatic and Medicinal Plant Units Carpentry, bamboo and reed crafts, other Wood Products Industries, rubber, NWFP etc. Works to be under taken includes study the nature of industrial and business organization–structure, raw material–collection and processing of raw-material, hands on practicals, production and management process, marketing and financial management.

			Marks	

Course Code	Name of Subject	Credit	External	Internal	Total
SOA/FSEC106P	Socio-Economic Survey and Village Attachment (20 days)	4	100	-	100
Practical – Data collection, use of PRA techniques with respect to village profile including socio- economic and cultural status, farm technology used, homesteads, agro forestry, biodiversity etc., Bench Mark survey of plant resources (cropping pattern, homesteads, agro forestry, biodiversity, yield system etc.), Schedule development, tabulation, analysis and preparing plan of work. Understanding local forestry and other village level institutions (Panchayat, Village Forest Committees, cooperations, youth/women groups etc.), People’s participation in developmental programmes with special reference to forestry. Exercises on the use of extension methods and teaching aids for transfer of technology.					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC106P	All India Tour*	3	-	-	-
Practical – Three weeks’ duration To familiarize the students with the flora, fauna and other research activities of forestry faculty in university, research institutes, forest industries, govt. and private organization of different parts of India. To expose the students to various national/heritage monuments as part of national integration activity.					

Elective Courses

Student needs to earn six (6) credits from the Electives. In addition to following electives, students are free to choose electives from other departments of the School of Agriculture.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE122T	Wildlife Management	2	70	30	100
Theory- Theory- Definition, History of wildlife management and conservation in India, Values of wildlife - aesthetic, recreational, scientific, educational, commercial, farming, technological and ecological values. Zoogeographic regions of the world – Palearctic region, nearctic region, oriental region, Ethiopian region, Neotropical region, Australasian region. Major biomes of the world – polar region, coniferous forests, temperate forests, tropical forests, grasslands, deserts, mountains, inland waters, oceans and oceanic islands. Biogeographic zones of India - trans-Himalayan, Himalayan, Indian desert, semi-arid, Western Ghats, Deccan peninsula, Gangetic plain, North East India, islands, coasts. Habitat requirements of animals. Red Data Book and red listing, IUCN revised red list categories – Extinct, Extinct in the wild, Vulnerable, Near Threatened and Least concerned. Wildlife census: purpose, techniques. Direct and indirect methods of population estimation. Sample and total counts, indices, encounter rates and densities, block counts, road side counts, dung counts, pug mark census, water hole census, line transect- statistical analysis. Telemetry- transmitters, receivers, analysis of data, visual tagging and marking. Captive wildlife: Zoos and safari parks. Captive breeding for conservation. Central Zoo Authority of India. Wildlife (Protection) Act, 1972. Special projects for wildlife conservation. Project Tiger and Musk Deer Project. Introduction and reintroduction of species. Wildlife corridors. MAB, CITES. Wildlife Damage - appraisal, control and management. Healthcare, disease management and nutrition in Wild animals Protected areas concept, wildlife sanctuaries and national parks, biosphere reserves, major protected areas of India.					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE122P	Wildlife Management	1	100	-	100

Practical –

Exercise on the census methods - direct method - total count, block count, water hole count, capture - recapture method, point transect, and line transect method – use of software for analysis. Exercise on the census methods - indirect methods, dung count for elephants, pugmark method for larger cats and pellet count for other ungulates. Pitfall trap, mist net, Sherman trap, camera trap, and other traps to study the wildlife. Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques. Wildlife damage and control: Questionnaire survey. Wildlife photography.

Suggested Reading:

- Davil, J.W. et al. 1981. Infectious diseases of wild mammals. Ed. II. Iowa State University Press, USA.
- International Zoo Books, Published by New York Zoological Society, New York
- Krebs C & Davis N. 1978. Introduction to behavioral ecology. Oxford University Press
- Lever, C. 1985. Naturalized mammals of the world. John Wiley, London
- Mills, L.S. 2013. Conservation of Wildlife Populations Demography, Genetics and Management (Ed.2). Wiley-Blackwell.
- Rajesh, G. 1995. Fundamentals of Wildlife Management, Justice Home, Allahabad.
- Sawarkar B. Wildlife Management. Wildlife Institute of India. Dehra Dun
- Wildlife Institute of India (2004) Compendium on the notes on the course Captive management of Endangered Species. Wildlife Institute of India. Dehra Dun
- Wodroffe, G. 1981. Wildlife conservation and modern zoo. Saiga Publishing Co., England
- Zoos Print and Zoo Zen, Published by Zoo Outreaches Organization, Coimbatore.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE123T	Agricultural Informatics	2	70	30	100

Theory-

Theory- Computer Programming-General Concepts, documentation and program maintenance, debugging programs, errors. Introduction to visual basic, java, fortran, C/ C++, etc, concepts and standard input/output operations, Variables and Constants, Operators and Expressions, Flow of control, Inbuilt and User defined functions, programming techniques for agriculture/forestry. e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in agriculture/forestry. ICT for Data Collection, formation of development programmes, monitoring and evaluation of Programmes. Computer models in agriculture/forestry: statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. IT application for computation of water and nutrient requirement of crops. Computer-controlled devices (automated systems) for Agri-input management. Smartphone mobile apps in agriculture for farm advises, market price, postharvest management etc, Geospatial technology- concepts, techniques, components and uses for generating valuable agri-information. Decision support systems-taxonomy, components, framework, classification and applications in agriculture/forestry, DSS, agriculture information/ expert system, soil information Systems etc for supporting farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FE123P	Agricultural Informatics	1	100	-	100

Practical –

Practical- Study of Computer components, accessories, practice of important DOS commands. Introduction of different operating systems such as windows, Unix, Linux, Creating, Files & Folders, FileManagement. Use of MS-WORD and MS Power point for document, handling of tabular data, animation, video tools, art tool, graphics, template & designs. MS-EXCEL - creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros. MS-ACCESS: creating database, preparing queries and reports, demonstration of Agri-information system.

Introduction to World Wide Web (WWW) and its components, creation of scientific website, presentation and management agricultural information through web. Introduction of various programming languages such as Visual Basic, Java, Fortran, C, C++, and their components Hands on practice on writing small programmes. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost. Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools. Use of smart phones and other devices in agro-advisory and dissemination of market information. Introduction of Geospatial Technology, demonstration of generating information important for Agriculture. Hands on practice on preparation of Decision Support System.

* Non credit course

Total Credit to earn in the Semester VII

Core	AECC	SEC	ELECTIVE	TOTAL
08	0	08	06	22

Note: Theory (T) and Practical (P) are linked to each other.

**B.Sc. (Hons) FORESTRY [Eight (8) Semesters] CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF INSTRUCTIONS AND CREDITS**

**Details Syllabus
Semester-VIII**

Student READY- Forestry Work Experience (FOWE)

Core Courses

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC129P	Forest Range Training Program (50 days)	10	100	-	100
<p>Practical – Visit to modern forest nurseries, herbal gardens and watersheds, study the felling and logging operations, timber lots and important industrial products, study or working plan, enumeration, volume and yield calculation & compartment history files, study the 'CAT' (Catchment Area Treatment Plan) and FDA (Forest Development Agencies). Use of forestry equipments/ instruments. Study the regeneration and management of important forestry tree species. Sample plots, layout studies, stump analysis, preparation of local volume tables. Study the working of other Forestry related organizations/industries.</p> <p>At the Wildlife Sanctuaries/National Parks/Tiger Reserves, the students are expected to learn about the aspects related with the preparation of the management plans/conservation plans, to undertake and familiarize the various wildlife population enumeration techniques and the biodiversity assessment techniques. To undertake pilot studies on the man-animal conflicts and other issues in the forest areas etc.</p>					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FC130P	Report Writing and Presentation (12 days)	2	100	-	100
<p>Practical – Compilation of the work/experience detailing the objectives, places and persons visited, work done, experiences/skills gained and suggestions for improvement of training. (Photographs/statics) Presentation of the report before faculty. The assessment will be based on Project Report evaluation and viva-voce.</p>					

Self and Social Development Course (SSDC)*

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSSDC01P	Orientation (10 days)	1	100	-	100
<p>Practical – Conducting various exercises for exposing the students on the recent trends in the field of forestry, transactional analysis, personality development, soft skills etc. Various fields of forestry and environment for placement, internship and to prepare students for the rigours of professional life after completing B.Sc. Forestry programme.</p>					
Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSSDC02P	Weapon Training and First Aid Training (5+3=8 days)	1	100	-	100

Practical –

Hands on training in the handling of various kinds of weapons and their operation, limitations and precautions during their use. Getting basic know ledge on different first aid practices which are required in case of field emergencies, like snakebite, animal attack, poachers and accidents. Also to learn about the first aid to be given to wild animals in distress and volunteering in rural health services.

Skill Enhancement Course (SEC)

Course Code	Name of Subject	Credit	Marks		Total
			External	Internal	
SOA/FSEC108P	Project Work & Dissertation	10	100	-	100

Theory-

This course shall provide the B.Sc. (Hons) Forestry students an understanding of the principles and procedures of the experimental design, layout, analysis and interpretation of data and technical writing. Each student shall work on a specific research project to be identified with the help of the supervising teacher. They shall also prepare and present a proposed plan of work (PPW) specifying the objectives and procedures of the study and present the same before an audience consisting of faculty and students. The research work will be conducted leading to the preparation of a project report in the format and style of M.Sc. thesis. Evaluation will be done based on the quality of work, quality of report and its presentation before an audience consisting offaculty and students. (Project shall be small on which can be completed within 90 days of the semester duration).

Total Credit to Earn in the Semester VIII

Core	AECC	SEC	SSDC	TOTAL
12	0	10	02	24

Note: Theory (T) and Practical (P) are linked to each other.

