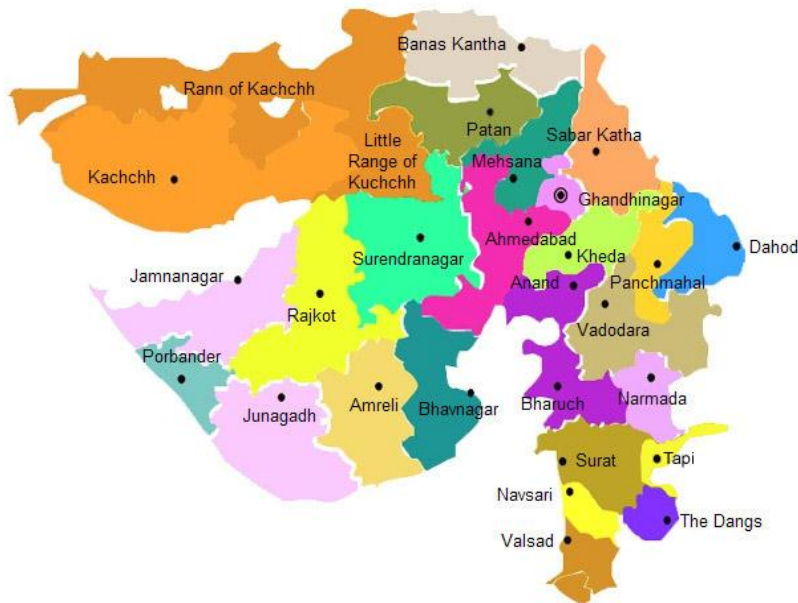


B.Sc. Forestry (Hons)

College of Forestry

COURSE SYLLABUS REVISED AS PER ICAR IV DEAN'S COMMITTEE RECOMMENDATIONS



NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI, GUJARAT- 396450

Recommendations for new Curriculum for B.Sc. Forestry (Hons)

**ANNEXURE - V
EXISTING DEPARTMENTWISE COURSES IN FORESTRY**

Course no	Title	Credits	Semester	Page
I. Silviculture and Agroforestry				
SAF.1.1	Fundamentals of Horticulture (Same as FRT.1.1)	3(2+1)	I	15
SAF.2.1	Principles & Practices of Silviculture	4(3+1)	II	15
SAF.2.2	Nursery Management (Same as FRT.2.1)	2(1+1)	II	16
SAF.2.3	Environmental Science (Same as NRMH.2.2)	3(2+1)	II	17
SAF.3.1	Forest Mensuration	3(2+1)	III	18
SAF.4.1	Silviculture of Indian Trees	3(2+1)	IV	19
SAF.4.2	Livestock Management	2(1+1)	IV	19
SAF.5.1	Plantation Forestry	2(1+1)	V	20
SAF.5.2	Silviculture Systems	2(2+0)	V	20
SAF.5.3	World Forestry Systems	2(2+0)	V	20
SAF.6.1	Agroforestry Systems and management	3(2+1)	VI	21
	Total -I	29(20+9)		
II. Forest Biology & Tree Improvement				
FBT.2.1	Forest Ecology, Biodiversity & Conservation	3(2+1)	II	22
FBT.3.1	Principles of Tree Improvement	3(2+1)	III	22
FBT.3.2	Tree Seed Technology	2(1+1)	III	23
FBT.4.1	Dendrology	3(2+1)	IV	24
FBT.4.2	Fundamentals of Wild Life	2(2+0)	IV	25
FBT.4.3	Forest Pathology	3(2+1)	IV	25
FBT.5.1	Wild Life Management	3(2+1)	V	26
FBT.6.1	Forest Entomology and Nematology	3(2+1)	VI	27
	Total II	22(15+7)		
III. Forest Products & Utilization				
FPU.3.1	Wood Anatomy	2(1+1)	III	28
FPU.3.2	Logging and Ergonomics	2(1+1)	III	28
FPU.4.1	Wood Products and Utilization	2(1+1)	IV	29
FPU.4.2	Wood Science and Technology	3(2+1)	IV	30
FPU.5.1	Ethnobotany	3(2+1)	V	31
FPU.6.1	Utilization of Non- Timber Forest Products	3(2+1)	VI	31

FPU.6.2	Medicinal and Aromatic Plant (Same as OTH.6.1)	3(2+1)	VI	32
	Total -III	18(11+7)		
IV. Natural Resource Management (Forestry)				
NRMF.1.1	Fundamentals of Geology and Soil Science	3(2+1)	I	32
NRMF.1.2	Agrometerology	2(1+1)	I	33
NRMF.2.1	Principles of Hydrology, Soil and water Conservation	3(2+1)	II	34
NRMF.2.2	Chemistry and Fertility of Forest Soils	3(2+1)	II	34
NRMF.3.1	Soil Survey, Remote Sensing and Wasteland Development	3(2+1)	III	35
NRMF.3.2	Forest Engineering	2(1+1)	III	36
NRMF.3.3	Organic Farming (Same as NRMH. 3.2)	2(1+1)	III	37
NRMF.5.1	Rangeland Management	3(2+1)	V	37
NRMF.5.2	Forest Business Management		V	38
NRMF.5.3	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)	V	38
NRMF.6.1	Forest Management, Policy and Legislation	3(2+1)	VI	38
NRMF.6.2	Marketing and Trade of Forest Produce	3(2+1)	VI	39
	Total -IV	31(19+12)		
V. Basic Sciences & Humanities				
BSH.1.1	Plant Biochemistry and Biotechnology (Same as BSC.1.2)	3(2+1)	I	40
BSH.1.2	Principles of Cytology and Genetics (Same as FRT. 1.2)	3(2+1)	I	41
BSH.1.3	Computer Application (Same as BSC.1.1)	2(1+1)	I	41
BSH.1.4	Principles of Plant Physiology (Same as BSC.1.3)	2(1+1)	I	42
BSH.1.5	Introductory Forest Economics (Same as BSC.1.4)	2(2+0)	I	42
BSH.1.6	Structural Grammar and Spoken English (Same as BSC.1.5)	2(1+1)	I	43
BSH.1.7	NCC/NSS/Physical Education (Same as OTH.1.1)	1(0+1)	I	43
BSH.1.8	Introductory Botany (Same as BSC.1.7)	3(2+1)	I	44

BSH.2.1	Elementary Statistics (Same as BSC.2.1)	3(2+1)	II	45
BSH.3.1	Forest Tribology and Anthropology	2(2+0)	III	45
BSH.3.2	Basic Mathematics (Biology Group) (NC) (Deficiency Course)	3(3+0)	III	46
BSH.4.1	Fundamentals of Extension Education	2(1+1)	IV	46
BSH.4.2	Tree Physiology	3(1+1)	II	46
BSH.6.1	Entrepreneurship Development and Communication skills (Same as BSC.6.2)	2(1+1)	VI	48
	Total -V	29(19+10)		
VI. Forestry Work Experience				
FWE.7	FWE/ Hands-on-Training in specialized field report writing, presentation and viva- voice	0+20	VII	49
FWE.8	FEW with forest department including All Indian Education Tour of 3 Weeks, report writing, presentation and vive- voice	0+20	VIII	51
(A)	Total credits of credit courses –I TO VI	129(84+ 45)		
(B)	Total credits of Forestry work Experience	40(0+40)		
	GRAND TOTAL OF A+B	169(84+ 85)		
(C)	Total credits of non- credit Courses	001(0+1)		
(D)	Total credits of Deficiency Courses	003(2+1)		

ANNEXURE – VI
REVISED DEPARTMENTWISE COURSES IN FORESTRY from (2013-14)

Sr. No.	Title	Credits	Sem. No.	Course No.	Page No.
A. Silviculture and Agroforestry					
1	Fundamentals of Horticulture (Same as FRT.1.1)	3(2+1)	I	SAF.1.1	9
2	Principles & Practices of Silviculture	4(3+1)	II	SAF.2.2	9
3	Nursery Management (Same as FRT.2.2)	2(1+1)	II	SAF.2.3	10
4	Environmental Science (Same as NRMH.2.3)	3(2+1)	II	SAF.2.4	11
5	Forest Mensuration	3(2+1)	III	SAF.3.5	12
6	Silviculture of Indian Trees	3(2+1)	IV	SAF.4.6	13
7	Livestock Management	2(1+1)	IV	SAF.4.7	13
8	Plantation Forestry	2(1+1)	V	SAF.5.8	14
9	Silviculture Systems	2(2+0)	V	SAF.5.9	14
10	World Forestry Systems	2(2+0)	V	SAF.5.10	14
11	Agroforestry Systems and management	3(2+1)	VI	SAF.6.11	15
	Total	29(20+9)			
B. Forest Biology & Tree Improvement					
1	Forest Ecology, Biodiversity & Conservation	3(2+1)	II	FBT.2.1	16
2	Principles of Tree Improvement	3(2+1)	III	FBT.3.2	16
3	Tree Seed Technology	2(1+1)	III	FBT.3.3	17
4	Dendrology	3(2+1)	IV	FBT.4.4	18
5	Fundamentals of Wild Life	2(2+0)	IV	FBT.4.5	18
6	Forest Pathology	3(2+1)	IV	FBT.4.6	19
7	Wild Life Management	3(2+1)	V	FBT.5.7	20
8	Forest Entomology and Nematology	3(2+1)	VI	FBT.6.8	21
	Total	22(15+7)			
C. Forest Products & Utilization					
1	Wood Anatomy	2(1+1)	III	FPU.3.1	22
2	Logging and Ergonomics	2(1+1)	III	FPU.3.2	22
3	Wood Products and Utilization	2(1+1)	IV	FPU.4.3	23
4	Wood Science and Technology	3(2+1)	IV	FPU.4.4	24
5	Ethnobotany	3(2+1)	V	FPU.5.5	25
6	Utilization of Non- Timber Forest Products	3(2+1)	VI	FPU.6.6	25
7	Medicinal and Aromatic Plant (Same as OTH.6.4)	3(2+1)	VI	FPU.6.7	26
	Total	18(11+7)			
D. Natural Resource Management (Forestry)					
1	Fundamentals of Geology and Soil Science	3(2+1)	I	NRMF.1.1	26
2	Agrometeorology	2(1+1)	I	NRMF.1.2	27
3	Principles of Hydrology, Soil and water Conservation	3(2+1)	II	NRMF.2.3	28
4	Chemistry and Fertility of Forest Soils	3(2+1)	II	NRMF.2.4	28
5	Soil Survey, Remote Sensing and	3(2+1)	III	NRMF.3.5	29

	Wasteland Development				
6	Forest Engineering	2(1+1)	III	NRMF.3.6	30
7	Organic Farming (Same as NRMH. 3.5)	2(1+1)	III	NRMF.3.7	30
8	Rangeland Management	3(2+1)	V	NRMF.5.8	31
9	Forest Business Management	2(1+1)	V	NRMF.5.9	31
10	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)	V	NRMF.5.10	32
11	Forest Management, Policy and Legislation	3(2+1)	VI	NRMF.6.11	32
12	Marketing and Trade of Forest Produce	3(2+1)	VI	NRMF.6.12	33
	Total	31(19+12)			
E. Basic Sciences & Humanities					
1	Computer Application (Same as BSC.1.1)	2(1+1)	I	BSH.1.1	34
2	Principles of Plant Physiology (Same as BSC.1.2)	2(1+1)	I	BSH.1.2	34
3	Introductory Forest Economics (Same as BSC.1.3)	2(2+0)	I	BSH.1.3	35
4	Structural Grammar and Spoken English (Same as BSC.1.4)	2(1+1)	I	BSH.1.4	35
5	NCC/NSS/Physical Education (Same as OTH.1.1)	1(0+1)	I	BSH.1.5	36
6	Introductory Botany (Same as BSC.1.6)	3(2+1)	I	BSH.1.6	37
7	Elementary Statistics (Same as BSC.2.7)	3(2+1)	II	BSH.2.7	37
8	Forest Tribology and Anthropology	2(2+0)	III	BSH.3.8	38
9	Basic Mathematics (Biology Group) (NC) (Deficiency Course)	3(3+0)	III	BSH.3.9	38
10	Principles of Cytology and Genetics (Same as FRT. 3.6)	3(2+1)	III	BSH.3.10	39
11	Fundamentals of Extension Education	2(1+1)	IV	BSH.4.11	39
12	Tree Physiology	3(1+1)	IV	BSH.4.12	40
13	Plant Biochemistry and Biotechnology (Same as BSC.5.10)	3(2+1)	V	BSH.5.13	41
14	Entrepreneurship Development and Communication skills (Same as BSC.6.12)	2(1+1)	VI	BSH.6.14	42
	Total	29(19+10)			
F. Forestry Work Experience					
1	FWE/ Hands-on-Training in specialized field report writing, presentation and viva- voice	0+20	VII	FWE.7	43
2	FWE with forest department including All Indian Education Tour of 3 Weeks, report writing, presentation and vive- voice	0+20	VIII	FWE.8	47
(i)	Total credits of credit courses –A TO E	129(84+45)			
(ii)	Total credits of Forestry work Experience (F)	40(0+40)			
	GRAND TOTAL OF (i + ii)	169(84+85)			
	Total credits of non- credit Courses	7 (3+4)			

ANNEXURE – VII

EXISTING SEMESTERWISE COURSES IN FORESTRY

	Semester-I	Credits	Page
SAF 1.1	Fundamentals of Horticulture (Same as ERT.1.1)	3(2+1)	15
NRMF.1.1	Fundamentals of Geology Soil Science	3(2+1)	32
NRMF.1.2	Agrometeorology	2(1+1)	33
BSH.1.1	Plant Biochemistry and Biotechnology (Same as BSC.1.2)	3(2+1)	40
BSH.1.2	Principles of cytology and Genetics (Same asFRT.1.2)	3(2+1)	41
BSH.1.3	Computer application (Same asBSC.1.1)	2(1+1)	42
BSH.1.4	Principles of Plant physiology (Same asBSC1.3)	2(1+1)	42
BSH.1.5	Introductory Forest Economics (Same asBSC.1.4)	2(2+0)	43
BSH.1.6	Structural Grammar and Spoken English (Same asBSC.1.5)	2(1+1)	43
BSH.1.7	NCC/NSS/Physical Education (NC) (Same as OTH,,1.1)	1(0+1)	44
BSH.1.8	Introductory Botany (Same as BSC 1.7)	3(2+1)	
	Total	25(16+9)	
	Semester-II	Credits	
SAF.2.1	Principles & Practices of Silviculture	4(3+1)	15
SAF.2.2	Nursery Management (Same asFRT.2.1)	2(1+1)	16
SAF.2.3	Environmental Science (Same as NRMH.2.2)	3(2+1)	17
FBT.2.1	Forest Ecology, Biodiversity & Conservation	3(2+1)	22
NRMF.2.1	Principles of Hydrology, Soil & Water Conservation	3(2+1)	34
NRMF.2.2	Chemistry and Fertility of Forest Soils	3(2+1)	34
BSH.1.7	NCC/NSS/ (NC) (Same as OTH.1.1)	1(0+1)	43
BSH.2.1	Elementary Statistics (Same asBSC.2.1)	3(2+1)	45
	Total	21(14+7)	
	Semester-III		
SAF.3.1	Forest Mensuration	3(2+1)	18
FBT.3.1	Principles of Tree improvement	3(2+1)	22
FBT.3.2	Tree Seed Technology	2(1+1)	23
FPU.3.1	Wood Anatomy	2(1+1)	28
FPU.3.2	Logging and Ergonomcis	2(1+1)	28
NRMF.3.1	Soil Survey, Remote Sensing & Wasteland Development	3(2+1)	35
NRMF.3.2	Forest Engineering	2(1+1)	36
NRMF.3.3	Organic Farming (Same as NRMH.3.2)	2(1+1)	37
BSH.1.7	NCC/NSS/ (NC) (Same as OTH.1.1)	1(0+1)	43
BSH.3.1	Forest Tribology and Anthropology	2(2+0)	46

BSH.3.2	Basic Mathematics (Biology Group) (NC)	3(3+0)	46
	Total	21(13+8)	
	Semester-IV		
SAF.4.1	Silviculture of Indian Trees	3(2+1)	19
SAF.4.2	Livestock Management	2(1+1)	19
FBT.4.1	Dendrology	3(2+1)	24
FBT.4.2	Fundamentals of wild Life	2(2+0)	25
FBT.4.3	Forest Pathology	3(2+1)	25
FPU.4.1	Wood Products & Utilization	2(1+1)	29
FPU.4.2	Wood Science and Technology	3(2+1)	30
BSH.1.7	NCC/NSS/ (NC) (Same as OTH.1.1)	1(0+1)	43
BSH.4.1	Fundamentals of Extension Education	2(1+1)	46
BSH.4.2	Tree Physiology	3(2+1)	47
	Total	19(15+8)	
	Semester-V		
SAF.5.1	Plantation Forestry	2(1+1)	20
SAF.5.2	Silvicultural Systems	2(2+0)	20
SAF.5.3	World Forestry Systems	2(2+0)	20
FBT.5.1	Wildlife Management	3(2+1)	26
FPU.5.1	Ethnobotany	3(2+1)	31
NRMF.5.1	Rangeland Management	3(2+1)	37
NRMF.5.2	Forest Business Management	2(1+1)	38
NRMF.5.3	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)	38
	Total	19(13+6)	
	Semester-VI		
SAF.6.1	Agroforestry Systems and Management	3(2+1)	21
FBT.6.1	Forest Entomology and Nematology	3(2+1)	27
FPU.6.1	Utilization of Non-timber Forest Products	3(2+1)	31
FPU.6.2	Medicinal and Aromatic Plant (Same as OTH.6.1)	3(2+1)	32
NRMF.6.1	Forest Management, Policy and Legislation	3(2+1)	38
NRMF.6.1	Marketing and Trade of Forest Produce	3(2+1)	39
BSH.6.1	Entrepreneurship Development and Communication Skills (Same as BSC.6.2)	2(1+1)	48
	Total	20(13+7)	
	Total of I to VI Semester	129	
	Semester-VII		
FWE.7	Multidisciplinary courses/Vocational Training (0+20) Hands on Training/Experiential Learning: Areas of specialization for %hands-on training+ should be decided by each college/University as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a work plan for the relevant area of specialization. An end-to-end approach is to be followed in implementing the	20	49

	programme. While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional significance. All the students shall have an Advisor, who will guide the students in %Hands-on Training+. A total of 20 credits are allotted for %Hands-on Training+ and the evaluation of the same shall be done by the Committee appointed by the Dean of the respective college.		
FWE- 7.1	Medicinal and Forest Plants Nursery	10 (0+10)	
FWE- 7.2	Commercial apiculture (As Per APPENDIX- I)	10 (0+10)	
	Semester-VIII		
FWE.8		20	51
	Forestry Work Experience: (0+20) Total duration of the programme should be 20 weeks. 14 weeks of the programme shall focus on village and / or State Forest Department including 3 week all India tour. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation.		
FWE.8.1	Educational Tour	0+3	
FWE 8.2	Study Tour of North Gujarat	0+ 4	
FEW 8.3	Study Tour of Middle Gujarat	0+ 4	
FWE 8.4	Study Tour of Saurashtra Forest	0+ 4	
FEW 8.5	Study Tour of South Gujarat (As per APPENDIX II).	0+ 5	
	Grand Total	169	

ANNEXURE - VIII

REVISED SEMESTERWISE COURSES IN FORESTRY from 2013-14

Semester-I		Credits	Page
SAF 1.1	Fundamentals of Horticulture (Same as FRT.1.1)	2+1	9
NRMF.1.1	Fundamentals of Geology Soil Science	2+1	26
NRMF.1.2	Agrometeorology	1+1	27
BSH.1.1	Computer application (Same as BSC.1.1)	1+1	34
BSH.1.2	Principles of Plant Physiology (Same as BSC.1.2)	1+1	34
BSH.1.3	Introductory Forest Economics (Same as BSC.1.3)	2+0	35
BSH.1.4	Structural Grammar and Spoken English (Same as BSC.1.4)	1+1	35
BSH.1.6	Introductory Botany (Same as BSC 1.6)	2+1	37
BSH.1.5	NCC/NSS/Physical Education (NC) (Same as OTH.1.1)	0+1	36
Total		19(12+7)	
Semester-II			
SAF.2.2	Principles & Practices of Silviculture	3+1	9
SAF.2.3	Nursery Management (Same as FRT.2.2)	1+1	10
SAF.2.4	Environmental Science (Same as NRMH.2.3)	2+1	11
FBT.2.1	Forest Ecology, Biodiversity & Conservation	2+1	16
NRMF.2.3	Principles of Hydrology, Soil & Water Conservation	2+1	28
NRMF.2.4	Chemistry and Fertility of Forest Soils	2+1	28
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)	0+1	36
BSH.2.7	Elementary Statistics (Same as BSC.2.7)	2+1	37
Total		21(14+7)	
Semester-III			
SAF.3.5	Forest Mensuration	2+1	12
FBT.3.2	Principles of Tree improvement	2+1	16
FBT.3.3	Tree Seed Technology	1+1	17
FPU.3.1	Wood Anatomy	1+1	22
FPU.3.2	Logging and Ergonomics	1+1	22
NRMF.3.5	Soil Survey, Remote Sensing & Wasteland Development	2+1	29
NRMF.3.6	Forest Engineering	1+1	30
NRMF.3.7	Organic Farming (Same as NRMH.3.5)	1+1	30
BSH.3.8	Forest Tribology and Anthropology	2+0	38
BSH.3.9	Basic Mathematics (Biology Group) (NC)	3+0	38
BSH.3.10	Principles of cytology and Genetics (Same as FRT.3.6)	2+1	39
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)	0+1	36

		Total	24(15+9)	
Semester-IV				
SAF.4.6	Silviculture of Indian Trees		2+1	13
SAF.4.7	Livestock Management		1+1	13
FBT.4.4	Dendrology		2+1	18
FBT.4.5	Fundamentals of wild Life		2+0	18
FBT.4.6	Forest Pathology		2+1	19
FPU.4.3	Wood Products & Utilization		1+1	23
FPU.4.4	Wood Science and Technology		2+1	24
BSH.4.11	Fundamentals of Extension Education		1+1	39
BSH.4.12	Tree Physiology		2+1	40
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)		0+1	36
	Total		19(15+8)	
Semester-V				
SAF.5.8	Plantation Forestry		1+1	14
SAF.5.9	Silvicultural Systems		2+0	14
SAF.5.10	World Forestry Systems		2+0	14
FBT.5.7	Wildlife Management		2+1	20
FPU.5.5	Ethnobotany		2+1	25
NRMF.5.8	Rangeland Management		2+1	31
NRMF.5.9	Forest Business Management		1+1	31
NRMF.5.10	Principles of Forest Economics, Project Planning and Evaluation		1+1	32
BSH.5.13	Plant Biochemistry and Biotechnology (Same as BSC.5.10)		2+1	41
	Total		22(15+7)	
Semester-VI				
SAF.6.11	Agroforestry Systems and Management		2+1	15
FBT.6.8	Forest Entomology and Nematology		2+1	21
FPU.6.6	Utilization of Non-timber Forest Products		2+1	25
FPU.6.7	Medicinal and Aromatic Plant (Same as OTH.6.4)		2+1	26
NRMF.6.11	Forest Management, Policy and Legislation		2+1	32
NRMF.6.12	Marketing and Trade of Forest Produce		2+1	33
BSH.6.14	Entrepreneurship Development and Communication Skills (Same as BSC.6.12)		1+1	42
		Total	20(13+7)	
	Total of I to VI Semester		129	
Semester-VII				
FWE.7	Semester Multidisciplinary courses/Vocational Training (0+20)- Hands on Training/Experiential Learning: Areas of specialization for %hands-on training+ should be decided by each college/University as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a work plan for the relevant area of specialization. An end-to-end approach is to be followed in		20 (0+20)	43

	implementing the programme. While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional significance. All the students shall have an Advisor, who will guide the students in Hands-on Training . A total of 20 credits are allotted for Hands-on Training and the evaluation of the same shall be done by the Committee appointed by the Dean of the respective college.		
FWE- 7.1	Medicinal and Forest Plants Nursery	10 (0+10)	
FWE- 7.2	Commercial apiculture (As Per APPENDIX- I)	10 (0+10)	

Semester-VIII			
FWE.8	Forestry Work Experience: (0+20) Total duration of the programme should be 20 weeks. 14 weeks of the programme shall focus on village and /or State Forest Departments including 3 weeks all India tour. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation.	20 (0+20)	47
FWE.8.1	Educational Tour	0+3	
FWE 8.2	Study Tour of North Gujarat	0+ 4	
FEW 8.3	Study Tour of Middle Gujarat	0+ 4	
FWE 8.4	Study Tour of Saurashtra Forest	0+ 4	
FEW 8.5	Study Tour of South Gujarat (As per APPENDIX II).	0+ 5	
Grand Total		169	

DETAIL COURSE CURRICULUM

FORESTRY

Introduction: Forestry education in State Agricultural Universities is only two decades old although scientific forestry programmes to train forestry professionals were started as early as 1864. Year 1985 saw the inception of undergraduate forestry education in the country at YSPUHF, Solan and PDKV, Akola. This was followed by GBPUAT, Pantnagar and TNAU, Coimbatore in 1986. JNKVV, Jabalpur and OUAT, Bhubaneshwar in 1987 and NAU, Navsari in 1988 followed suit. Later on few more SAUs also started this programme and currently fifteen colleges/Departments of Forestry in SAUs are offering this programme. The first major exercise for developing uniform curricula was undertaken in February 1993 during a national workshop on Forestry Course Curriculum in India at YSPUHF, Nauni Solan, HP. In order to prepare the forestry graduates to deal with the emerging issues and challenges in forestry sector, the present curricula revision exercise has been under taken. The revision is aimed at introducing newer concepts and delete obsolete and overlapping course contents.

Mission: To develop technically qualified forestry professionals with sufficient skills to manage, conserve and develop diversified forestry resources and products leading to environment and livelihood security.

Objectives

- Equip forestry graduates with current trends and requirements of forestry.
- Enable them to help in forestry development and taking forestry entrepreneurship.
- Enable environmental protection, value addition of forestry products and make forestry farmers globally competitive.

Colleges and Programme

Sr.	College/University	Programmes
1	College of Forestry, YSPUHF, Solan	B.Sc, M.Sc, Ph.D
2	College of Agriculture, OUAT, Bhubaneswar	B.Sc
3	College of Forestry and Hill Agriculture, GBPUAT, Ranichauri	B.Sc and M.Sc
4	College of Forestry, PDKV, Akola	B.Sc
5	Forest College and Research Institute, TNAU, Mettupalayam	B.Sc, M.Sc, Ph.D
6	Faculty of Agriculture, JNKVV, Jabalpur	B.Sc
7	Faculty of Forestry, BAU, Ranchi	B.Sc, M.Sc
8	College of Forestry, Sirsi, (UAS), Dharwad	B.Sc, M.Sc
9	Department of Forestry, UBKV, Cooch Behar	M.Sc
10	College of Agriculture, PAU, Ludhiana	M.Sc
11	College of Horticulture and Forestry, MPUAT, Jhalawar	B.Sc
12	College of Forestry, Ponnampet, (UAS, Bangalore)	B.Sc
13	ASPEE College of Horticulture & Forestry, NAU, Navsari	B.Sc, M.Sc, Ph.D.
14	College of Forestry, SKUAST, Srinagar	B.Sc
15	College of Forestry, IGAU, Raipur	B.Sc, M.Sc
16	College of Forestry, KAU, Trichur	B.Sc
17	College of Forestry, CAU, Pasighat	B.Sc

Present status

- Number of colleges: Presently there are 17 colleges functioning under the SAUs offering forestry courses in India.
- RAWE: This program varies in the universities offering B.Sc. forestry as per the local requirements. In most of the cases the RAWE program (Rural Forestry Work Experience) is being implemented by way of attaching the students the respective forest departments for first hand knowledge of operations thereon. The credit loads vary from college to college starting from 0+6 to 0+25. Similarly the number of days of attachment also vary from 45 days to 67 days.
- Examination pattern: It is 100 % external in MPUAT, whereas in TNAU it is 60% internal and 40% external and in PDKV, Akola, it is 20% internal and 80% external. Similarly there are variations in other colleges also.

Recommendations for new Curriculum
DEPARTMENTWISE COURSES IN FORESTRY

Sr. No.	Title	Credits	Sem. No.	Course No.	Page No.
A. Silviculture and Agroforestry					
1	Fundamentals of Horticulture (Same as FRT.1.1)	3(2+1)	I	SAF.1.1	9
2	Principles & Practices of Silviculture	4(3+1)	II	SAF.2.2	9
3	Nursery Management (Same as FRT.2.2)	2(1+1)	II	SAF.2.3	10
4	Environmental Science (Same as NRMH.2.3)	3(2+1)	II	SAF.2.4	11
5	Forest Mensuration	3(2+1)	III	SAF.3.5	12
6	Silviculture of Indian Trees	3(2+1)	IV	SAF.4.6	13
7	Livestock Management	2(1+1)	IV	SAF.4.7	13
8	Plantation Forestry	2(1+1)	V	SAF.5.8	14
9	Silviculture Systems	2(2+0)	V	SAF.5.9	14
10	World Forestry Systems	2(2+0)	V	SAF.5.10	14
11	Agroforestry Systems and management	3(2+1)	VI	SAF.6.11	15
	Total	29(20+9)			
B. Forest Biology & Tree Improvement					
1	Forest Ecology, Biodiversity & Conservation	3(2+1)	II	FBT.2.1	16
2	Principles of Tree Improvement	3(2+1)	III	FBT.3.2	16
3	Tree Seed Technology	2(1+1)	III	FBT.3.3	17
4	Dendrology	3(2+1)	IV	FBT.4.4	18
5	Fundamentals of Wild Life	2(2+0)	IV	FBT.4.5	18
6	Forest Pathology	3(2+1)	IV	FBT.4.6	19
7	Wild Life Management	3(2+1)	V	FBT.5.7	20
8	Forest Entomology and Nematology	3(2+1)	VI	FBT.6.8	21
	Total	22(15+7)			
C. Forest Products & Utilization					
1	Wood Anatomy	2(1+1)	III	FPU.3.1	22
2	Logging and Ergonomics	2(1+1)	III	FPU.3.2	22
3	Wood Products and Utilization	2(1+1)	IV	FPU.4.3	23
4	Wood Science and Technology	3(2+1)	IV	FPU.4.4	24
5	Ethnobotany	3(2+1)	V	FPU.5.5	25
6	Utilization of Non- Timber Forest Products	3(2+1)	VI	FPU.6.6	25
7	Medicinal and Aromatic Plant (Same as OTH.6.4)	3(2+1)	VI	FPU.6.7	26
	Total	18(11+7)			

D. Natural Resource Management (Forestry)					
1	Fundamentals of Geology and Soil Science	3(2+1)	I	NRMF.1.1	26
2	Agrometeorology	2(1+1)	I	NRMF.1.2	27
3	Principles of Hydrology, Soil and water Conservation	3(2+1)	II	NRMF.2.3	28
4	Chemistry and Fertility of Forest Soils	3(2+1)	II	NRMF.2.4	28
5	Soil Survey, Remote Sensing and Wasteland Development	3(2+1)	III	NRMF.3.5	29
6	Forest Engineering	2(1+1)	III	NRMF.3.6	30
7	Organic Farming (Same as NRMH. 3.5)	2(1+1)	III	NRMF.3.7	30
8	Rangeland Management	3(2+1)	V	NRMF.5.8	31
9	Forest Business Management	2(1+1)	V	NRMF.5.9	31
10	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)	V	NRMF.5.10	32
11	Forest Management, Policy and Legislation	3(2+1)	VI	NRMF.6.11	32
12	Marketing and Trade of Forest Produce	3(2+1)	VI	NRMF.6.12	33
	Total	31(19+12)			
E. Basic Sciences & Humanities					
1	Computer Application (Same as BSC.1.1)	2(1+1)	I	BSH.1.1	34
2	Principles of Plant Physiology (Same as BSC.1.2)	2(1+1)	I	BSH.1.2	34
3	Introductory Forest Economics (Same as BSC.1.3)	2(2+0)	I	BSH.1.3	35
4	Structural Grammar and Spoken English (Same as BSC.1.4)	2(1+1)	I	BSH.1.4	35
5	NCC/NSS/Physical Education (Same as OTH.1.1)	1(0+1)	I	BSH.1.5	36
6	Introductory Botany (Same as BSC.1.6)	3(2+1)	I	BSH.1.6	37
7	Elementary Statistics (Same as BSC.2.7)	3(2+1)	II	BSH.2.7	37
8	Forest Tribology and Anthropology	2(2+0)	III	BSH.3.8	38
9	Basic Mathematics (Biology Group) (NC) (Deficiency Course)	3(3+0)	III	BSH.3.9	38
10	Principles of Cytology and Genetics (Same as FRT. 3.6)	3(2+1)	III	BSH.3.10	39
11	Fundamentals of Extension Education	2(1+1)	IV	BSH.4.11	39
12	Tree Physiology	3(1+1)	IV	BSH.4.12	40
13	Plant Biochemistry and Biotechnology (Same as BSC.5.10)	3(2+1)	V	BSH.5.13	41
14	Entrepreneurship Development and Communication skills (Same as BSC.6.12)	2(1+1)	VI	BSH.6.14	42
	Total	29(19+10)			

F. Forestry Work Experience					
1	FWE/ Hands-on-Training / experiential learning in specialized field report writing, presentation and viva- voice	0+20	VII	FWE.7	43
	Medicinal and Forest Plants Nursery Commercial apiculture (As Per APPENDIX- I)	0+10 0+10		FWE- 7.1 FWE- 7. 2	
2	FWE with forest department including All India educational tour of 3 Weeks, report writing, presentation and vive- voice	0+20	VIII	FWE.8	47
	Educational Tour Study Tour of North Gujarat Study Tour of Middle Gujarat Study Tour of Saurashtra Forest Study Tour of South Gujarat (As per APPENDIX II).	0+3 0+ 4 0+ 4 0+ 4 0+ 5		FWE.8.1 FWE 8.2 FEW 8.3 FWE 8.4 FEW 8.5	
(i)	Total credits of credit courses –A TO E	129(84+45)			
(ii)	Total credits of Forestry work Experience (F)	40(0+40)			
	GRAND TOTAL OF (i + ii)	169(84+85)			
	Total credits of non- credit Courses	7 (3+4)			

SEMESTERWISE COURSES IN FORESTRY

Semester-I		Credits	Page
SAF 1.1	Fundamentals of Horticulture (Same as FRT.1.1)	2+1	9
NRMF.1.1	Fundamentals of Geology Soil Science	2+1	26
NRMF.1.2	Agrometeorology	1+1	27
BSH.1.1	Computer application (Same as BSC.1.1)	1+1	34
BSH.1.2	Principles of Plant Physiology (Same as BSC.1.2)	1+1	34
BSH.1.3	Introductory Forest Economics (Same as BSC.1.3)	2+0	35
BSH.1.4	Structural Grammar and Spoken English (Same as BSC.1.4)	1+1	35
BSH.1.6	Introductory Botany (Same as BSC 1.6)	2+1	37
BSH.1.5	NCC/NSS/Physical Education (NC) (Same as OTH.1.1)	0+1	36
Total		19(12+7)	
Semester-II			
SAF.2.2	Principles & Practices of Silviculture	3+1	9
SAF.2.3	Nursery Management (Same as FRT.2.2)	1+1	10
SAF.2.4	Environmental Science (Same as NRMH.2.3)	2+1	11
FBT.2.1	Forest Ecology, Biodiversity & Conservation	2+1	16
NRMF.2.3	Principles of Hydrology, Soil & Water Conservation	2+1	28
NRMF.2.4	Chemistry and Fertility of Forest Soils	2+1	28
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)	0+1	36
BSH.2.7	Elementary Statistics (Same as BSC.2.7)	2+1	37
Total		21(14+7)	
Semester-III			
SAF.3.5	Forest Mensuration	2+1	12
FBT.3.2	Principles of Tree improvement	2+1	16
FBT.3.3	Tree Seed Technology	1+1	17
FPU.3.1	Wood Anatomy	1+1	22
FPU.3.2	Logging and Ergonomics	1+1	22
NRMF.3.5	Soil Survey, Remote Sensing & Wasteland Development	2+1	29
NRMF.3.6	Forest Engineering	1+1	30
NRMF.3.7	Organic Farming (Same as NRMH.3.5)	1+1	30
BSH.3.8	Forest Tribology and Anthropology	2+0	38
BSH.3.9	Basic Mathematics (Biology Group) (NC)	3+0	38
BSH.3.10	Principles of cytology and Genetics (Same as FRT.3.6)	2+1	39
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)	0+1	36
Total		24(15+9)	

Semester-IV			
SAF.4.6	Silviculture of Indian Trees	2+1	13
SAF.4.7	Livestock Management	1+1	13
FBT.4.4	Dendrology	2+1	18
FBT.4.5	Fundamentals of wild Life	2+0	18
FBT.4.6	Forest Pathology	2+1	19
FPU.4.3	Wood Products & Utilization	1+1	23
FPU.4.4	Wood Science and Technology	2+1	24
BSH.4.11	Fundamentals of Extension Education	1+1	39
BSH.4.12	Tree Physiology	2+1	40
BSH.1.5	NCC/NSS/ (NC) (Same as OTH.1.1)	0+1	36
	Total	19(15+8)	
Semester-V			
SAF.5.8	Plantation Forestry	1+1	14
SAF.5.9	Silvicultural Systems	2+0	14
SAF.5.10	World Forestry Systems	2+0	14
FBT.5.7	Wildlife Management	2+1	20
FPU.5.5	Ethnobotany	2+1	25
NRMF.5.8	Rangeland Management	2+1	31
NRMF.5.9	Forest Business Management	1+1	31
NRMF.5.10	Principles of Forest Economics, Project Planning and Evaluation	1+1	32
BSH.5.13	Plant Biochemistry and Biotechnology (Same as BSC.5.10)	2+1	41
	Total	22(15+7)	
Semester-VI			
SAF.6.11	Agroforestry Systems and Management	2+1	15
FBT.6.8	Forest Entomology and Nematology	2+1	21
FPU.6.6	Utilization of Non-timber Forest Products	2+1	25
FPU.6.7	Medicinal and Aromatic Plant (Same as OTH.6.4)	2+1	26
NRMF.6.11	Forest Management, Policy and Legislation	2+1	32
NRMF.6.12	Marketing and Trade of Forest Produce	2+1	33
BSH.6.14	Entrepreneurship Development and Communication Skills (Same as BSC.6.12)	1+1	42
	Total	20(13+7)	
	Total of I to VI Semester	129	
Semester-VII			
FWE.7	Hands-on-Training in Multidisciplinary courses/ Vocational Training in report writing, presentation and viva- voce	20 (0+20)	43
Semester-VIII			
FWE.8	Forest Work Experience with Forest department including All India Educational Tour of 3 weeks, report writing, presentation and viva-voce	20 (0+20)	47
	Grand Total	169	

NC: Non Credit 7 (3 +4)

Semester VII

FWE.7- Multidisciplinary courses/Vocational Training (0+20)

Hands on Training/Experiential Learning: Areas of specialization for %hands-on training+ should be decided by each college/University as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a work plan for the relevant area of specialization. An end-to-end approach is to be followed in implementing the programme. While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional significance. All the students shall have an Advisor, who will guide the students in %hands-on Training+. A total of 20 credits are allotted for %hands-on Training+ and the evaluation of the same shall be done by the Committee appointed by the Dean of the respective college.

1. **FWE- 7.1- Medicinal and Forest Plants Nursery - 10 (0+10)**
 2. **FWE- 7. 2- Commercial apiculture - 10 (0+10)**
- (As Per Annexure- I)*

Semester VIII

FWE.8- Forestry Work Experience (FWE) : (0+20)

Total duration of the programme should be 20 weeks. 14 weeks of the programme shall focus on village and/ or State Forest Departments including 3 weeks all India tour. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation.

FWE.8.1	Educational Tour	0+3
FWE 8.2	Study Tour of North Gujarat	0+ 4
FEW 8.3	Study Tour of Middle Gujarat	0+ 4
FWE 8.4	Study Tour of Saurashtra Forest	0+ 4
FEW 8.5	Study Tour of South Gujarat	0+ 5

(As per APPENDIX II)

FORESTRY

I. SILVICULTURE & AGROFORESTRY

SAF.1.1: Fundamentals of Horticulture (Same as FRT.1.1) 3(2+1)

Economic importance and classification of horticultural crops and their culture and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery management practices, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens . principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops, nursery techniques and their management. Principles and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management, weed management, fertility management in horticultural crops, cropping systems, intercropping, multi-tier cropping, mulching, bearing habits, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming.

Practical: Features of orchard, planning and layout of orchard, tools and implements, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits and vegetables, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

SAF.2.2: Principles and Practices of Silviculture 4(3+1)

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

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

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

SAF.2.3: Nursery Management (Same as FRT.2.2)

2(1+1)

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy (scarification & stratification) internal and external factors, types of seed germination, methods for breaking seed dormancy, nursery techniques, apomixes . mono-embryony, polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, nursery tools, containers, media and implements, use of growth regulators in seed and vegetative propagation, methods and techniques of cutting, layering, grafting and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs like bulb, rhizome, corm, runners, suckers, etc. Micro-propagation and Micro-grafting, establishment of nursery-site selection, planning and lay out of nursery area, types of nursery, different types of beds, pre-sowing treatments, methods of seed sowing, pricking, watering, weeding, hoeing, fertilization, shading, root culturing technique, lifting windows, grading, packing, storage and transportation. Hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

Practical: Media for propagation of plants in nursery beds, pot and mist chamber. Preparation of nursery beds, pre-sowing treatments and sowing of seeds of different size- small, medium and large. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting and repotting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labeling and packing of fruit and other plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Top grafting, bridge grafting and nursery management. Nutrient and plant protection applications during nursery.

SAF. 2.4: Environmental Science (Same as NRMH.2.3)

3 (2+1)

Environment: introduction, definition and importance. Components of environment - interactions with organisms. Global and Indian environment - past and present status. Environmental pollution and pollutants. Air, water, food, soil, noise pollution - sources, causes and types. Smog, acid rain, global warming, ozone hole, eutrophication, sewage and hazardous waste management. Impact of different pollutions on humans, organisms and environment. Introduction to biological magnification of toxins. Deforestation - forms and causes, relation to environment. Prevention and control of pollution - technological and sociological measures and solutions - Indian and global efforts. India, international and voluntary agencies for environmental conservation - mandates and activities. International conferences, conventions and summits - major achievements. Environmental policy and legislation in India. Introduction to environmental impact assessment. Causes of environmental degradation - socio-economic factors. Human population growth and lifestyle.

Practical: Visit to local areas - river /forest/ Horticulture farm/ grassland /catchments etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques.

SAF.3.5: Forest Mensuration

3(2+1)

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

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

SAF.4.6: Silviculture of Indian Trees

3(2+1)

Origin, distribution, general description, phenology, silvicultural characters, regeneration methods, silvicultural systems and economic importance of the following conifer and broadleaved tree species of India. Conifers: *Cedrus deodara*, *Pinus roxburghii*, *Pinus wallichiana*. Broad leaved species: *Tectona grandis*, *Shorea robusta*, *Acacia* spp., *Dalbergia sissoo*, *D latifolia*, *Anogeissus* spp. *Populus* spp, *Eucalyptus* spp. *Casuarina equisetifolia*, *Terminalia* spp., *Santalum album*, *Albizia* spp, *Prosopis* spp. *Pterocarpus santalinus*, *Azadirachta indica*, *Diospyros melanoxylon*, *Bixa orellana*, *Bombax ceiba*, Tropical pines, *Adina cordifolia*, *Lagerstroemia* spp, *Gmelina arborea*, *Madhuca indica*, *Leucaena leucocephala* and Bamboos.

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

SAF.4.7: Livestock Management

2(1+1)

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

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

SAF.5.8: Plantation Forestry**2(1+1)**

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

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

SAF.5.9: Silvicultural Systems**2(2+0)**

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

SAF.5.10: World Forestry Systems**2(2+0)**

Geographical distribution of forests and their classification. Critical examination of the world forest he sources, productivity potential and increment of world forests. Forest resources and forestry practices in different regions of the world

. North and South America, Europe, Africa, China, Japan, Russia, South-East Asia and Australia. Forest development and economy . forest based industries of the world. Recent trends in forestry development in the world. International forestry organizations.

SAF.6.11: Agroforestry System and Management

3(2+1)

Indian agriculture - its structure and constraints. Land use definition, classification and planning. Agroforestry - definition, aims, objectives and need. Traditional agroforestry systems: Taungya system, Shifting cultivation, wind break, shelterbelts, Homestead gardens'. Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations. Classification of agroforestry system -structural, functional, socio-economic and ecological basis. Multipurpose tree species and their characteristics. Tree architecture, canopy management - lopping, pruning, pollarding and hedging. Diagnosis and design. Agroforestry systems in different agroclimatic zones, components, production and management techniques. Nutrient cycling, soil conservation, watershed management and climate change mitigation. Economics of agroforestry systems. People participation, rural entrepreneurship through agroforestry and industrial linkages. Analysis of fodder and fuel characteristics of tree/shrubs. Financial and socio-economic analysis of agroforestry systems.

Practical: Study characteristics of trees/shrubs/grasses for agroforestry. Volume and biomass estimation. Crown measurement, light interception and moisture measurement in agroforestry systems. Annual crops/grass growth measurements and yield estimation. Analysis of soil and plant samples for organic carbon N,P and K. Diagnosis and design - methodology. Survey agroforestry practices in local/ adjoining areas.

II. FOREST BIOLOGY AND TREE IMPROVEMENT

FBT.2.1: Forest Ecology and Biodiversity

3(2+1)

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

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

FBT.3.2: Principles of Tree Improvement

3 (2+1)

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

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

FBT.3.3: Tree Seed Technology

2(1+1)

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

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

FBT.4.4: Dendrology

3(2+1)

Introduction . importance and scope of dendrology, Morphology of woody plants and range of variation. Principles and systems of classification of plants. Bentham and Hooker's, Engler and Prantles, and Hutchinson's Systems. Plant Nomenclature . objectives, principles and International Code of Botanical Nomenclature. Role of vegetative morphology in identification of woody forest flora. Peculiarities of tree stems, twigs, general form of woody trunk and deviations like buttresses, flutes, crooks, etc. Morphology and description of barks of common trees. Characteristics of blaze on bark, colour, gums, latex, etc. Morphology of leaf, description of different types of leaves, colour of young and old leaves in some species as (regular) features of identification. Reproductive morphology of plants with reference to description and identification of reproductive parts. Floristics and procedures; herbarium techniques, collection, processing and preservation of plant material. General study of herbarium, arboretum and xylarium. Description of the plant in scientific terms, study of sport characteristics of plants, naming and classifying based on adopted system. Study of families, as survey of forest resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, Papilionaceae, Meliaceae, Salicaceae, Apocynaceae, Betulaceae, Verbenaceae, Fagaceae, Compositae, Moraceae, Poaceae, Tiliaceae, Liliaceae, Euphorbiaceae, Pinaceae, Dipterocarpaceae, Cupressaceae, Guttiferae, Taxaceae, Myrtaceae and Combretaceae. Geographical distribution of important Indian trees, native trees, exotic trees, endemism, allelopathy with respect to forest trees. Visit to forest areas and Botanical Garden.

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

FBT.4.5: Fundamentals of Wildlife

2 (2+0)

Introduction: Definition of wildlife, free living, captive, domesticated and feral animals. Justification of wildlife conservation, uses, values and negative impact of wildlife. Zoogeographic regions and biomes of the world. India's uniqueness

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

FBT.4.6: Forest Pathology

3(2+1)

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

Practical: Study of microscope and micrometry; Collection, observation and preservation of diseased specimens and pathogenic structures; Morphological characters of fungi and bacteria; Morphological characters of viruses and

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

FBT.5.7: Wild Life Management

3(2+1)

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

Practical: Field/laboratory studies of distinct and characteristics morphological and other features of fishes, reptiles, birds and mammals. Identification and study of wildlife in a nearby zoo. Bird watching : Preparation of inventory of an area. Direct and indirect methods of studying food habits of different wildlife. Studying habitat management and manipulation techniques. Wildlife damage and control : Questionnaire survey.

FBT.6.8: Forest Entomology and Nematology

3(2+1)

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

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

Note: Region specific aspects may be changed based on the locality

III. FOREST PRODUCTS AND UTILIZATION

FPU.3.1: Wood Anatomy

2(1+1)

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

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

FPU.3.2: Logging and Ergonomics

2(1+1)

Definition and scope of logging, logging plan and execution. Location and demarcation of the area for logging and estimation of produce available for extraction. Implements used in logging operation- traditional and improved tools. Felling rules and methods. Conversion, measurement and description of converted material. Means of transport of timber- carts, dragging, skidding, overhead transport, ropeways, skylines. Transport by road and railways. Transport by water- floating, rafting and concept of booms. Grading and Storage of timber in the depots for display and disposal, temporary and final storage. Timber Depots- types, lay out and management. Systems of disposal of timber. Size of material in logging operation. Ergonomics: definition,

components and provision of energy. Requirement of energy and rest periods. Effect of heavy work, posture, weather and nutrition. Personal protective equipments, safety helmets, ear and eye protections. Accidents: causes, statistics, safety rules and first aids. Plants, animals and insect infestations; diseases and their prevention.

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

FPU.4.3: Wood Products and Utilization

2(1+1)

Pulp and paper industry. Introduction and raw material; pulping-mechanical, chemical, semichemical and semi-mechanical; pulp bleaching; stock preparation and sheet formation; types of paper; manufacture of rayon and other cellulose derived products. Manufacture, properties and uses of Composite wood- plywood, fiberboard, particleboard and hard board. Adhesives used in manufacture of composite wood. Improved wood-definition, types (impregnated wood, heat stabilized wood, compressed wood, and chemically modified wood). Destructive distillation of wood. Saccharification of wood. Production of wood molasses, alcohol and yeast.

Practical: Visit to paper industry to study pulp and papermaking. Study of different types of papers. Study of different types of paper boards. Visit to Rayon industry. Visit to plywood industry to study the manufacturing processes.

Study of plywood, fiberboards, particleboards, and hard boards. Visit to other wood based industries. Visit to wood distillation unit. Visit to nearby industrial plantations. Study of types of improved wood.

FPU.4.4: Wood Science and Technology

3(2+1)

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

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

FPU.5.5: Ethnobotany

3(2+1)

Definition and scope of ethnobotany. Man and biological resource of earth with respect to plants. 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. Symbolic relationships including mythology mainly from the following families. Guttiferae (Clusiaceae), Rosaceae, Malvaceae, Fabaceae, Mimosaceae, Caesalpinaceae, Combretaceae, Umbelliferae (Apiaceae), Rubiaceae, Asteraceae, Ebenaceae, Apocynaceae, Asclepiadaceae, Euphorbiaceae, Lauraceae, Palmaceae, Poaceae, Liliaceae, Coniferae, Santalaceae, Thymeliaceae.

Practical: Visit to various places to collect information regarding traditional uses of plants. (This also includes nearby tribal areas).

FPU.6.6: Utilization of Non-Timber Forest Products

3(2+1)

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

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

FPU.6.7: Medicinal and Aromatic Plants (Same as OTH.6.4)**3(2+1)**

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

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

4. NATURAL RESOURCE MANAGEMENT**NRMF.1.1: Fundamentals of Geology and Soil Science****3(2+1)**

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

density-factors influencing-field bulk density. Relation between BD.PD-Practical Problem. Pore space-definition-factors affecting capillary and noncapillary porosity-soil colour-definition-its significance-colour 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-air capacity-composition-factors influencing-amount of air space-soil air renewal, soil temperature-sources and distribution of heat-factors influencing-measurement, chemical properties-soil colloids-organic-humus-inorganic-secondary silicate-clay-hydrous oxides. Soil organic matter decomposition-pH-nutrient availability-soil buffering capacity, soil water-forms-hygroscopic capillary and gravitational-soil moisture constants-hygroscopic coefficient-wilting point-field capacity-moisture equivalent, maximum water holding capacity, energy concepts-pF scale measurement-gravimetric-electric and tensiometer methods-pressure plate. and pressure membrane apparatus-Neutron probe-soil water movement-saturated and unsaturated infiltration and percolation-soil survey . classification.aerial photography. satellite.their interpretation, soil orders-land capability-classification, soils of different eco-systems and their properties; water quality parameters and assessment.

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 I & II; Excursion tour for identification of rocks and minerals and profile studies; Practical introduction to Tensiometer, pressure plate and neutron probe etc.

NRMF.1.2: Agrometeorology

2(1+1)

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

Practical: Study of temperature instruments, pressure instruments, humidity instruments, wind instruments, rain instruments and wind rose. Solar radiation instruments with pyranometer. Monthly variation of rainfall at Navsari. Lay out of

an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew.

NRMF 2.3: Principles of Hydrology, Soil and Water Conservation 3(2+1)

Definition and importance of Hydrology, Hydrological cycle, weather and hydrology, rainfall measurement and analysis, hydrologic properties, infiltration, runoff, water holding capacity of soils, free water, capillary water, hygroscopic water, ground water, evapotranspiration, water yield, study of hydrographs. Recharging of water wells and springs. Wasteland Management: Objectives, components, runoff, factors affecting runoff, stream flow and stream gauging. Sedimentation, factors affecting sedimentation, flood and its control measures. Afforestation and forest management in wasteland areas. Soil erosion, universal soil loss equation, soil and water conservation practices and soil conservation structure like contour and graded bunding. Bench terracing and bench bank stabilization. Waterways their design, layout, construction, stabilization and maintenance. Methods of land leveling, its cost estimation, their location and design. Water harvesting structures and farm ponds. Irrigation Source: Water wells, aquifers, water application methods; surface, subsurface, drip and sprinkler irrigation system. Drainage: types of drainage systems, their selection, design, installation and maintenance.

Practical: 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; Study of flood control reservoirs; Drainage and reclamation of water logged lands; Measurement of irrigation water by various method; Design of graded bunds; Design and layout of waterways; Survey design and layout of bench terraces; Design and layout of diversion channels; Study of different water harvesting structures; Land leveling and its cost estimation; Study of drip irrigation system; Study of sprinkler irrigation system; Study of pumping system; Economic analysis of wasteland development.

NRMF.2.4: Chemistry and Fertility of Forest Soils 3(2+1)

Introduction; Forest soils Vs. cultivated soils. Properties of soils under different forest ecosystems. Soil colloids and exchange phenomenon. Essential nutrient elements-occurrence, availability and their functions. Diagnosis of nutrient deficiencies-visual symptoms, soil fertility evaluation methods. Site productivity and nutrient cycling in forest soils. N,P and K, Macro and micronutrient fertilizers and their uses. Brief history of Microbiology. Forest soil environment-

distribution of various microorganisms in soil ecosystem and their interaction effects. Mineral Transformation-carbon cycle with reference to organic matter decomposition and humus formation, Microbial degradation of cellulose & lignin. Bio-fertilizers . their importance. Nitrogen fixation-Rhizobium-tree legume symbiosis, Frankia X non-legume symbiosis, asymbiotic and associative N₂ fixation. Nitrification and denitrification in forest ecosystems. Microbial transformation of phosphorous, sulphur and micro nutrients. Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. Rhizosphere and phyllosphere concept.

Practical: Study of forest soil profile; Determination of C.E.C. and exchangeable cations; Determination of soluble cations (Ca,Mg,Na, K); Determination of soluble anions (HCO₃,CO₃,Cl, SO₄); Determination of available N, P & K content of soil; 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.

NRMF 3.5: Soil Survey, Remote Sensing and Wasteland Development

3(2+1)

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

reclamation. Sites with superficial impervious hard pan. Eroded ravines and gullies, various techniques of afforestation of adverse sites, trees suitable for adverse sites. Afforestation and reclamation of mine wastes. Stabilization of tailing dumps and prevention of dust pollution. Sewage water as source of tree nutrients.

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

NRMF.3.6: Forest Engineering

2(1+1)

Engineering 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 sloppy grounds, chaining across obstacles; cross staff surveying, compass surveying, chain and compass traversing, magnetic and true bearings, 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 levels, dumpy level and its adjustments, booking of staff readings, calculation of reduced levels. Contour surveying. Building materials . types, strength and characteristics, site selection for building construction. Forest roads . alignment, construction and drainage; retaining walls, breast walls, waterways and culverts; bridges . types, selection of site, simple wooden beam bridges, check dams, farm ponds, earth dams.

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 of building plans; Design of waterways; Design of simple wooden beam bridge; Design of retaining walls; Design of check dams

NRMF.3.7: Organic Farming (Same as NRMH.3.5)

2(1+1)

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures,

vermicomposting, green manuring, recycling of organic residues, bio-fertilizers; Soil improvement and amendments; Integrated diseases and pest management . use of bio-control agents, bio-pesticides pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

Practical: Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management.

NRMF.5.8: Rangeland Management

3(2+1)

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

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

NRMF.5.9: Forest Business Management

2(1+1)

Nature and scope of business management as related to forestry Management principles and functions. Relationship between business firms (horizontal and vertical integration). Key decision areas in Forest business management.

Planning for forest business- types of planning. Business accounting - need, types and systems of accounting. Basics of inventory management and business finance: estimating capital requirement and sources of capital; Measures of analyzing efficiency of the business: Human Resource Management - manpower training and planning. Domestic and international trade in forest products - analyzing trends, concept of absolute and comparative advantage, offer curve analysis and systems of trade.

Practical:

Visits to selected business firms/markets to study their structure and conduct and exercises on estimating demand and supply of commercially important forest products: inventory management and account keeping. Trends in export and import of forestry outputs.

NRMF.5.10: Principles of Forest Economics, Project Planning and Evaluation **2(1+1)**

Nature and scope of forest economics, importance of forestry in economic development. Concepts of demand, derived demand and supply with special reference forestry outputs. Basic characteristics of forestry production problems of forestry & its measures. Financial and economic rotations. Fundamentals of project planning and evaluation and network scheduling techniques. Valuation of timber and non-timber forest products.

Practical: Exercises on demand and supply, production functions, price analysis, benefit-cost ratio and other measures of financial feasibility, CPM and PERT approaches.

NRMF.6.11: Forest Management, Policy and Legislation **3(2+1)**

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

Policies. Forest Law: legal definition. Objects of special forest law. Indian Forest Act. Detailed study of IFA 1927. Gujarat State Forest Acts and Rules.

Practical: Visit to plantations of different age gradations, record the actual growing stock and workout increments. Visit to forests and enumerate the stock and test one of the method for yield regulation. Study the various units adopted in the forest management. Study of various records and forms maintained in the office of the RFO with regard to management of forests under their control. Study of procedure for seizure of property. Visit to forest department and courts to observe penalty procedures. Preparation of first information report and enactment report. Study of working plans of the forests and to prepare the working plan for one of the area in the range.

NRMF.6.12: Marketing and Trade of Forest Produce

3(2+1)

Nature and scope of marketing. Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets. Marketing channels, costs, margins and price spread . concepts and applications. Concepts of market integration and marketing efficiency. Role of public and private agencies in marketing of forest produce. Economic futures of specialized markets. Fundamentals of international trade. Domestic and international trade in timber and non-timber forestry outputs. Demand forecasts . concept and methods. WTO . background, structure, functions and decision making process. E-marketing of forest product, Dunkell proposal, Intellectual property and patenting.

Practical: Library review of studies on marketing, visits to local timber and non-timber markets; collection and analysis of price and quantity data for various forest products; study of marketing channels and price spread for important timber and non-timber forestry products.

V. BASIC SCIENCES AND HUMANITIES

BSH.1.1: Computer Application (Same as BSC.1.1)

2(1+ 1)

Theory : Introduction to computers and personal computers. Characteristics of computer. Basic concepts . structure and basic works of computer. Hard ware . input and output devices, primary and secondary memory. Classification of computer. Soft ware and it types. Windows operating system . its basic, mouse operation, understanding the desktop, understanding the window, managing files and folders. Introduction to Internet and email. Introduction to MS Office.

Winword : Adding and deleting the text. Word wrapping. Selection. Moving and copying. Search and replace. Character formatting. Page margins. Text justification. Navigating in the document. Line spacing. Using menubar. Using the toolbars : standard and formatting. Editing the document. Introduction to table. Excel : Introduction to spread sheets. Cell address. Using menubar. Using the toolbars : standard and formatting. Use of formula bar. Manipulating the data. Mathematical and statistical calculation and their readymade functions. Introduction to graphs. Power point : Creating the presentation.

Practical : Studies on computer components. Basics of Windows operating system. Practicing Internet and email. Winword : Creating and editing document. Hands on use of menubar, standard and formatting toolbars. Creating tables. Practicing the other Winword topics covered in theory.

Excel : creating and editing document. Hands on use of menubar, standard and formatting toolbars. Use of formula bar. Mathematical and statistical calculation and their readymade functions use. Creating the graphs. Practicing the other Excel topics covered in theory. Power point : Creating the presentation.

BSH.1.2: Principles of Plant Physiology (Same as BSC.1.1)

2(1+1)

Water relations in plants: role of water in plant metabolism, osmosis, imbibition, diffusion, water potential and its components, measurement of water potential in plants, absorption of water, mechanisms of absorption, ascent of sap. Stomata, structure, distribution, classification, mechanisms of opening and closing of stomata, osmotic pressure, guttation, transpiration, methods and mechanism, factors affecting transpiration. Different types of stresses: water, heat and cold tolerance, mechanism of tolerance. Plant nutrition: essentiality, mechanism of absorption, role in plant metabolism, Photosynthesis, importance of photosynthesis, Structure and function of chloroplast, dark and light reactions, , CO₂ fixation, C₃, C₄ and CAM, advantages of C₄ pathway, photorespiration and its implications. Factors affecting the photosynthesis. Respiration, glycolysis, TCA cycle and Electron transport chain, ATP synthesis and factors affecting the

respiration. Phyto-hormones, physiological role in controlling plant process. Environmental stimuli for plant development.

Practical: Measurement of water potential by different methods, Osmosis . demonstration, Plasmolysis . demonstration, Root pressure . demonstration, Transpiration rate, Studying the structure of stomata, studying the opening and closing of stomata, Demonstration of importance of light in photosynthesis, Estimation of plant pigments, Studying the activity of catalase, Detection of phenols in plants, Studying the plant movements,

BSH.1.3: Introductory Forest Economics (Same as BSC.1.3) 2(2+0)

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption . theory of consumer behaviour, laws of consumption, classification of goods. Wants . their characteristics and classification, utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi-marginal utility, indifference curve and its properties, consumer equilibrium. Theory of demand, demand schedule and curve, market demand. Price, income and cross elasticities, Engle's law of family expenditure . consumer's surplus. Theory of firm, factors of production . land and its characteristics, labour and division of labour, theories of population. Capital and its characteristics . classification and capital formation. Enterprises . forms of business organization . merits and demerits. Laws of return . law of diminishing marginal return . cost concepts. Law of supply . supply schedule and curve elasticities. Market equilibrium, distribution . theories of rent, wage, interest and profit. Price determination and forecasting under various market structures.

BSH.1.4: Structural Grammar and Spoken English 2(1+1)
(Same as BSC.1.4)

Structural Grammar: Introduction to Word Classes, Structure of the Verb in English, Uses of Tenses, Study of Voice, Use of Conjunctions and Prepositions, Sentence Structures and Patterns in English, Articles, Concord, Vocabulary and Composition, Use of Dictionaries-Thesauri and Theory of Translation.

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, Concepts of Debate, Group Discussion, Elocution and Extempore.

Practical:

Structural Grammar: Exercises on Theoretical Topics, Common Mistakes in English, Diary Writing, Translation of General and Scientific Passages, Vocabulary Building, Comprehension Writing, Essay Writing, Paragraph Writing, Précis Writing, Letter Writing and Report Writing.

Spoken English: Short Talks, Dialogues, Conversations related to Everyday Situations, Preparation for Debate- Group Discussion, Elocution and Extempore Speeches, Reading Newspapers- Books and magazines.

BSH.1.5: NCC/ NSS /Physical Education (Same as OTH.1.1) (NC) 1(0+1)

Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: 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, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, 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, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defense, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games . football, hockey, cricket, volleyball, ball badminton, throw ball, tennikoit. Participation in one of the indoor games . shuttle badminton, chess and table tennis. Rules and regulations of athletic

Practical: Construction of frequency distribution table. Graphical representation of data : histogram, frequency polygon, frequency curve; bar chart - simple, multiple, component and percentage bar charts; pie chart. Mean, median, mode and quadrille for row and grouped data. Standard deviation and coefficient of variation for row and grouped data. Tests for equality of means : one sample and two(independent) sample; paired t-tests. Chi-square test for contingency tables and theoretical ratios. Correlation and linear regression.

BSH.3.8: Forest Tribology and Anthropology

2(2+0)

Anthropology . definitions, nature and scope of Anthropology. Branches of Anthropology & methods of anthropological study, Concepts of Culture, Society, Community, Groups and Institutions. important Indian Tribes, (Races), Gonds, Santhals, Bhil, Kolis, Nagas etc.. Social Institutions: Family . forms and functions, Marriage . forms and functions, Kinship . decent, residence, Systems terminology and usages, Tribal Economy, Tribal religion. Meaning, definitions and characteristics of Tribes. History of Indian Tribes. Tribal Demography. Tribal - Social and Political organization. Tribal Law and Justice. Tribal taboo and Totem. Socio-cultural and socio-economic problems of tribes with special reference to indebtedness, land alienation, shifting cultivation, migration, depopulation, un-employment, impact of urbanization and industrialization, education and forest problems. Social Forestry programme, individual oriented and community oriented scheme, Forest and Tribes . their relationship. forest ecosystem and cottage industries. Role of Tribals in Forest protection, development & conservation. Tribal welfare and social forestry, Tribals and Co-operative movements. Tribal welfare and administration - the Constitutional safeguards for the scheduled tribes. Tribal rights and concession. The role of anthropology in tribal development.

BSH.3.9: Basic Mathematics (Biology Group) (NC)

3(3+0)

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

BSH.3.10: Principles of Cytology and Genetics (Same as FRT.3.6) 3(2+1)

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

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

BSH.4.11: Fundamentals of Extension Education 2(1+1)

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and types of education, Formal, informal non-formal education, and differences of Formal and Informal 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), Technology Assessment and Refinement Programme (TARP) etc. 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) & Rapid Rural Appraisal (RRA). Rural social groups, primary and secondary groups, formal, informal group, temporary, permanent groups, references group, classification of group.

Practical: Visits to study structure, functions, linkages and extension programmers of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Deptt. of Forest. Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. and AVA like OHP. Identification of local leaders to study their role in extension work. Preparing rural leaders training programme for forestry and study of organizations of Youth Clubs in Rural Area. Preparation of Village Agricultural productions plan.

BSH.4.12: Tree Physiology

3(2+1)

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

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

BSH.5.13: Plant Biochemistry and Biotechnology
(Same as BSC.5.10)

3(2+1)

Carbohydrates-occurrence and classification-structures of glucose, fructose, ribose, maltose, lactose, starch and cellulose, physical and chemical properties of carbohydrates-isomerism, optical activity, reducing property, reaction with acids and alkalis-osazone formation. Lipids classification- important fatty acids and triglycerides, essential fatty acids -rancidity of oils acids value, saponification value & iodine value -phospholipids-types and importance-plant pigments-structure and function of chlorophyll and carotenoids-sterols-basic structure. Protein - classification - functional and solubility - amino acids-classification and structureessential amino acids - properties of amino acids-colour reactions, amphoteric nature and isomerism-structure of proteins . primary, secondary, tertiary and quaternary properties and reactions of proteins. Enzymes-classification and mechanism of action-factors affecting enzyme action-cofactors and coenzymes - vitamins and mineral as coenzymes/cofactorscarbohydrate metabolism-glycolysis and TCA cycle-metabolism of lipids - lipases and phospholipases-fatty acid oxidation. Biosynthesis of fatty acids, protein metabolism proteolytic enzyme, electron transport chain-ATP formation, bioenergetics of glucose and fatty acids. Photosynthesis and nitrogen fixation structure and component of nucleic acids, replication, transcription and translation. Historical developments in biotechnology. Application of plant tissue culture in plant improvement Micropropagation: Principales and application in forestry trees and medicinal plants; meristem culture; plant cell and suspension cultures; organogenesis and regeneration in vitro and somaclonal variations; genetic engineering techniques; transgenic plants with case studies of tree species to diseases, production of secondary metabolites; germplasm conservation; An introduction to bioinformatics, genomics and proteomics, biodegradation of forestry wastes through genetically engineered microbes.

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

BSH.6.14. Entrepreneurship Development and Communication Skills

(Same as BSC.6.12)

2(1+1)

Entrepreneurship Development: Assessing overall business environment in the Indian economy. 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, Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. 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. Areas of extension education in marketing, privatization and extension services. Differences between a capitalist and an entrepreneur, functions of entrepreneur, qualities of a successful entrepreneur.

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

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, précis writing, summarizing, abstracting; individual and group presentations.

Appendix- I

VII SEMESTER

FWE.7 FORESTRY WORK EXPERIENCE (EXPERIENTIAL LEARNING)

FWE.7.1 Medicinal and Forest Plants Nursery- 10 (0+10)

Month	Week	Activity	Credits
FWE.7.1.1 Orientation and fundamentals of nursery management			0+1
July	1 st week	General orientation to students regarding forest nursery A. Basics of plan production and nursery techniques B. Edaphic, climatic and socio-economic conditions of south Gujarat. C. Demand, supply and need of nursery plants D. Potential purchasers E. Resources available F. vi. Fixing objectives	
FWE.7.1.2 Field Exposure to Nurseries			0+1
July	2 nd week	Training to students at commercial and departmental nurseries	
FWE.7.1.3 Project Execution			0+8
August	3 rd week	Preliminary preparations for the nursery A. Collection of materials and instruments required for nursery operations B. Site selection and Lay out and planning irrigation C. Soil and water analysis, data collection (nursery site data), photographs and reporting	

	4 th week	Advance planning A. Seed collection, temporary seed storage, seed treatments, etc B. Gathering sand, silt, FYM, chemical fertilizers and vermi compost, poly bags, earthen pots and other plant containers C. Soil working D. Preparation of seed beds and filling bags E. Data recording(Germination test, viability tests), photograph and reporting	
September October November & December	1 st , 2 nd , 3 rd and 4 th weeks of respective months	Seed sowing/ Planting and after care A. Planning time of sowing, quantity of seed and other propagules B. Pre-sowing treatment to seeds/vegetative propagules C. Sowing/planting D. Basal dose of fertilizers E. Data recording, photographs and reporting F. Planning and managing irrigation G. Cleaning and weeding in nursery H. Fertilizer application I. Plant protection J. Growth data recording, photographs and reporting	
December	4 th Week	Report writing, presentation and Viva voce	

FWE 7.2 – Commercial Apiculture - 10 (0+10)

Month	Week	Activity	Credits
FEW.7.2.1- Introduction, biological structure, social behavior, feeding, diseases and pest of bees. Study of bee boxes and bee flora.			0+4
July	1 st week	✓ Introduction ✓ Importance of the Apiculture ✓ Study of important bee species <ul style="list-style-type: none"> • <i>Apis cerana indica</i> • <i>A.mellifera</i> • <i>A.florea</i> • <i>A.dorsata</i> 	

		<ul style="list-style-type: none"> • Non- <i>Apis</i> species 	
		<ul style="list-style-type: none"> ✓ Honey bee as biological indicators of ecosystem health ✓ Study of the honeybees, bee flora and Honey flow period. ✓ Bee floral park development 	
		<ul style="list-style-type: none"> ✓ Study of bee flora available in July month and growing potential bee plants in bee floral park 	
	2 nd week	<ul style="list-style-type: none"> ✓ Study of bee morphology, anatomy, colony organization and life cycle ✓ Social behavior of honey bee 	
	3 rd week and 4 th week	<ul style="list-style-type: none"> ✓ Study of Honey bee boxes for <i>Apis cerana</i> and <i>A. mellifera</i>. ✓ Preparation of Honey bee boxes. ✓ Selection of wood species for preparing Honey bee boxes. 	
August		<ul style="list-style-type: none"> ✓ Bee migration (if required) 	
	1 st week	<ul style="list-style-type: none"> ✓ Study of bee flora available in August month and growing potential bee plants in bee floral park 	
		<ul style="list-style-type: none"> ✓ Market study of Honey bee products 	
	2 nd week	<ul style="list-style-type: none"> ✓ Study of insect pest and disease in honey bee 	
	3 rd and 4 th week	<ul style="list-style-type: none"> ✓ Study of artificial feeding in food scarcity period ✓ Study of bee equipments. 	
		<ul style="list-style-type: none"> ✓ Bee migration (if required) 	

FWE 7.2.2- Study of swarming, multiplication of colonies, pesticidal effects on bees. Study of Bee products.			0+3
September	1 st -2 nd week	<ul style="list-style-type: none"> ✓ Study of bee flora available in September month and growing potential bee plants in bee floral park 	
		<ul style="list-style-type: none"> ✓ Study of swarming and catching the bee swarm from nature. ✓ Queen production and rearing technique 	
	3 rd -4 th week	<ul style="list-style-type: none"> ✓ Separation of Bee colonies (multiplication) ✓ Bee migration (if required) 	
October	1 st week	<ul style="list-style-type: none"> ✓ Study of bee flora available in October month and growing potential bee plants in bee floral park 	
	2 nd week	<ul style="list-style-type: none"> ✓ Study of pesticidal effect on Honey bee 	
	3 rd and 4 th week	<ul style="list-style-type: none"> ✓ study of other bee products like propolis, wax, Royal jelly, bee venom etc. 	
		<ul style="list-style-type: none"> ✓ Bee migration (if required) 	

FWE 7.2.3 Study of wax and Honey extraction. Selling of products.			0+3
November	1 st week	<ul style="list-style-type: none"> ✓ Study of bee flora available in November month and growing potential bee plants in bee floral park 	
		<ul style="list-style-type: none"> ✓ Visit to commercial apiary. 	
		<ul style="list-style-type: none"> ✓ Wax extraction ✓ Honey extraction ✓ Study of honey processing. 	
	2 nd to 4 th week	<ul style="list-style-type: none"> ✓ Honey testing (nutritional analysis) ✓ Study of Quality standards for honey (testing of honey for its purity) 	
December	1 st -2 nd and 3 rd week	<ul style="list-style-type: none"> ✓ Study of bee flora available in December month 	
		<ul style="list-style-type: none"> ✓ Selling of bee products ✓ Study of Economics of Bee rearing (cost benefit analysis) 	
		4 th week	<ul style="list-style-type: none"> ✓ Report writing, presentation and Viva voce.

Appendix- II

SEMESTER VIII

FWE. 8 Forestry Work Experience (FWE)

Course No.	Course Title	Credits	Days
FWE.8.1	Educational tour <ul style="list-style-type: none"> • Studying Forestry components in the states of North India 	0+3	21
FWE.8.2	Study of North Gujarat Forest <ul style="list-style-type: none"> • Visit to State Forest Department Headquarter, Gandhinagar and interaction with top officers • Attachment with Gujarat Forest Research Institute (GFRI), Gandhinagar and studying research interventions in forestry • Attachment with GEER Foundation, Gandhinagar and studying different components of nature education • Attachment with Bhaskaracharya Institute of Space Application and Geoinformatics (BISAG), Gandhinagar • Study of Drought Prone Area Programme (DPAP) • Ornithological study at Nalsarovar Bird Sanctuary • Study of zoo management at Kankaria Zoo, Ahmedabad • Industrial attachment with ANALA OUTDOORS, Ahmedabad and studying perspectives of nature based tourism • Project work with Centre for Environment Education (CEE) and VIKSAT, Ahmedabad • Study of social forestry plantations in Gandhinagar and Ahmedabad Forest Circle • Attachment with Sardar Patel Institute of Public Administration (SPIPA), Ahmedabad • Study of social forestry works of Mehsana circle • Studying the bird diversity at Thol Bird Sanctuary • Visit to Taranga hill plantation • Study of wildlife management at Jasore Sloth bear Sanctuary and Balaram-Ambaji Sanctuary, Banaskantha • Study of different components of Sardar Krishinagar Dantiwada Agricultural University, Dantiwada • Ecological study at Kutch Desert Sanctuary • Visit to Narayan Sarovar Sanctuary • Study of Kutch Bustard Sanctuary • Industrial attachment with Sarjan Biotech, Bhuj 	0+4	28
FWE.8.3	Study of Middle Gujarat Forest <ul style="list-style-type: none"> • Study the activities of Gujarat State Forest Development Corporation (GSFDC), Vadodara • Study of aesthetic forestry of Vadodara 	0+4	28

	<ul style="list-style-type: none"> • Project study of Dhanvantari Project • Study the management of captive animals in Sayaji Zoo • Visit to GNFC, Vadodara • Study the different components of Anand Agricultural University, Anand • Visit and interaction with Institute of Rural Management (IRMA) and National Dairy Development Board (NDDB), Anand • Visit to GIS Unit of forest department, Vadodara • Study of wildlife management at Ratanmahal Sloth bear Sanctuary • Study the activities of Gujarat Energy Development Agency (GEDA), Vadodara • Study of wood based industries at Sankheda • Visit to Bhaikaka farm and studying organic farming • Project study of Panam Irrigated Plantation Project • Visit and study the management of Shoolparneshwar and Jambughoda Wildlife Sanctuary • Study the research activities of forest department at Godhra Research Range • Study of Forest vegetation, Plantations management, wild life sanctuary etc of Dediapada, Sagai, Sagbara, Piplod/ Sorapada Ranges of Rajpipla East Forest Division, - Clonal plantation of Khair, Shisham, Mahuda etc, • Improvement planting Rehabilitation of Degraded forests in Dediapada Range • Rearing of Four Horned Antelopes at Sagai Range • Study of Silva division, Clonal plant Nursery, Arboretum, clonal plantation of Eucalyptus, Teak, Casuarinas, Dalbergia, Cleisanthes, etc. • Study of Narmada Project Division Work (Catchments area plantation) • Study of Afforestation around Sardar Sarovar Dam, Kevadia colony • Study of Shoolparneshwar Wildlife Sanctuary 		
FWE.8.4	Study of Saurashtra Forest <ul style="list-style-type: none"> • Study of coral reefs, marine wildlife at Marine National Park • Ornithological study at Khijadiya Bird Sanctuary • Study the techniques of Mangrove plantation and nursery preparation • Visit to plantation of Reliance Industries, Jamnagar • Visit to Wind harvesting unit, Jamnagar • Study of wildlife at Wild Ass Sanctuary, Bajana • Industrial placement with Dessert Salt Factory, Jainabad • Study of wildlife and rangeland management at Velavadar 	0+4	28

	<p>Blackbuck Sanctuary</p> <ul style="list-style-type: none"> • Visit to Vithubahi Farm, Bhavnagar • Study of Nature education sanctuary, Bhimkui, Hingolghadh, • Study the Watershed Development work of Rajkot district • Study the captive breeding at Sakkarbag Zoo, Junagadh • Study the different components of Junagadh Agricultural University, Junagadh • Visit to Botanical Garden, Motibaug and Lalbaug, Junagadh • Study of project lion, ecotourism and man-animal conflict at Gir National Park and Sanctuary 		
FWE.8.5	<p>Study of South Gujarat Forest</p> <ul style="list-style-type: none"> • Study of working plan management at working circle, Surat • Industrial attachment with J. K. Paper mill, Songadh • Socio-economic surveys-Village attachment with Agakhan Rural Support Programme(AKRSP), Netrang • Study of Mangrove plantation around Hajira and olpad • Study the activities of Surat Nature Club, Surat • Study of ecotourism at Kilad Ecotourism Site • Wildlife and ecological study at Vansda National Park • Study of Botanical Garden, Waghai, • Industrial attachment with VANIL Udhyog, Navtad to study wood preservation, treatments, wood workshop and saw mills • Study of Social Forestry division, Navsari • Study of biodiversity of Dangs • Production, collection, marketing and scope of Non-Timber Forest Products of Dangs • Wildlife and Ecotourism study at Purna Wildlife Sanctuary • Project study of activities of BAIF • Visit to hill Afforestation of Saputara • Industrial attachment with Atul Ltd, Valsad • Study the activities of World Wide Fund For Nature (WWF), Valsad division • Industrial attachment with Bamboo craft unit, Ambapada 	0+5	35
Total		0+20	140

Note:

The broad areas of training components mentioned above under each course are indicative. The components to be covered will be decided by the committee constituted by the Dean based on administrative convenience.