

CENTRAL AGRICULTURAL UNIVERSITY

Academic Regulations

and

Course Syllabus

for

**Under Graduate Programme in Forestry
(B.Sc. Forestry)**



COLLEGE OF HORTICULTURE AND FORESTRY
Central Agricultural University, Pasighat
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A: ACADEMIC REGULATIONS

1. General Aspects and Glossary of Terms

1.1 General

1.1.1 Authority for making regulations

These regulations are made as per the provision under section 18(1) of the Central Agricultural University Act 1992 (No.40 of 1992) and the statute 14(3) of the Central Agricultural University, Imphal.

1.1.2 Short title and commencement

These regulations shall be called “Central Agricultural University Academic Regulations 2007 for Undergraduate Studies” and shall be applicable to the students admitted during the Academic year 2007-08 and onwards.

1.1.3 Scope

The provisions made in these academic regulations shall apply to all Bachelor’s degree programmes offered by the University except the B.V.Sc & A.H. course to which model regulations framed by the VCI shall apply. However, wherever the VCI regulations are silent, these regulations shall also apply to B.V.Sc. & A.H. programme.

1.1.4 Interpretations

The decision of the Academic Council of CAU shall be final and no suit, application, petition, revision or appeal shall lie in any Court of Law or in any authority outside the University in respect of interpretation of these Regulations.

1.2 Academic year and duration of the degree programmes

1.2.1 The academic year shall generally commence from last Monday of July of each year. However, the Academic Council has the authority to decide the exact dates and months of commencement and termination of an academic year. An academic year shall be divided into two semesters and shall include the inter-semester break.

1.2.2 A semester shall generally consist of 22 weeks and shall have not less than 110 working days including 95 net instructional days and 15 days for examinations. The study tour shall be organized during inter-semester break. Any study tour if needs to be organized during the semester, loss of instructional days have to be compensated.

1.2.3 Co-curricular activities shall be organized simultaneously with academic activities after class hours. Loss of instructional days due to inter class/inter collegiate competitions in sports/games/cultural activities etc., or due to any other reason shall be compensated by providing additional instructional days. Any change in the notified schedule of academic year/semester due to any unforeseen reason shall be affected with the approval of the Vice-Chancellor and shall be placed before the Academic Council for information.

1.2.4 The minimum number of classes for each one credit of a course shall be 16 in a semester.

1.2.5 The minimum and maximum durations of residential requirement for undergraduate degree programme in forestry shall be 4 years (8 Semesters) and 6 years (12 Semesters), respectively.

In case a student fails to complete the degree programme within the maximum duration of residential requirement, his admission shall stand cancelled.

1.3 Definitions of academic terms

- 1.3.1 **Advisor** means a teacher of the College nominated by the Dean for counseling academic matters to a group of students.
- 1.3.2 **Curriculum** refers to a group of courses approved to meet the requirements for the fulfillment of a degree programme.
- 1.3.3 **Course** means a unit of instruction in a discipline carrying a specific number and credit(s) and to be covered in a semester as laid down in detail in the syllabus of a degree programme.
- 1.3.4 **Syllabus** refers to a detailed outline of courses approved for the fulfillment of a particular degree programme.
- 1.3.5 **Credit** means the unit of workload per week for a particular course in theory and/or practical. One credit of theory means one class of one-hour duration and one credit practical means one class of minimum two hour's duration per week or 3 hours field work per week.
- 1.3.6 **Credit load** of a student refers to the total number of credits of all the courses he registers during a particular semester.
- 1.3.7 **Grade Point (GP)** of a course is a measure of quality of work done. It is obtained by dividing the percent mark secured by a student in a particular course with 10, expressed up to second decimal place.
- 1.3.8 **Result** is a measure of performance in a course at the end of the semester. The result for each course registered shall be declared as follows:

Grade point obtained /symbol	Result	Value
5.00 and above	Pass	G.P. as indicated
Less than 5.00 (F)	Fail	Zero
“SA”	Shortage of Attendance	Zero
“S”	Satisfactory	
“US”	Unsatisfactory	

- 1.3.9 **Credit Point (CP)** refers to the Grade Point multiplied by the number of credits of the course, expressed up to second decimal place.
- 1.3.10 **Grade Point Average (GPA)** means the total points earned by a student divided by total number of credits of all the courses registered in a semester, expressed up to second decimal place.
- 1.3.11 **Cumulative Grade Point Average (CGPA)** means the total credit points earned by a student divided by the total number of credits registered by the end of a semester (all completed semesters), expressed up to second decimal place.
- 1.3.12 **Overall Grade Point Average (OGPA)** means the total credit points earned by a student in the entire degree programme divided by the total number of credits required for the degree, expressed up to second decimal place.

2. Students Admission and Academic Programme

2.1 Admission requirements

2.1.1 Candidates seeking admission to UG degree programme of the University must have secured not less than 50% marks in aggregate in Physics, Chemistry, Biology/Mathematics or Agriculture at 10 + 2 examination for general category and 40% marks for SC/ST and other special category including physically handicapped/in-service candidates.

- (i) Candidates should have passed 10 + 2 examination with English as one of the subjects of study.
- (ii) The candidates must have attained 17 years of age on 31st July of the year of admission.
- (iii) The selection/nomination of candidates should be made through Common Entrance Test conducted by the State concerned.

2.1.2 Students seeking admission to any of the above degree programmes shall be permanent resident or domicile of any one of the six North East States of India. *Viz.*, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim and Tripura.

2.1.3 The number of students to be admitted from each of the six North East States mentioned at 2.1.2 to different degree programmes shall be as notified by the University from time to time.

2.2 Selection of candidates for admission

2.2.1 The candidates to be sponsored for admission to different degree programmes shall be from the merit list based on the performance in a Common Entrance Test, conducted by the States concerned.

2.2.2 Fifteen per cent of the approved number of seats in all U.G. programmes shall be filled up by the candidates selected on the basis of All India Entrance Test (AIET) conducted by the ICAR or as amended from time to time by ICAR.

2.2.3 The ICAR nominees shall be governed by the eligibility as prescribed by the ICAR.

2.3. Admission

2.3.1 Date of admission

The date of admission to a Bachelor's degree programme shall be as per the announcement made in the Prospectus/Academic Calendar/Semester Calendar and notified by the Registrar.

2.3.2 Documents required at the time of admission

Each student seeking admission in the University shall submit an application in the prescribed form with the following certificates and documents in original before the Admission Committee constituted for the purpose:

- (i) Pass Certificate for 10+2 Examination
- (ii) Marks sheet of 10+2 Examination
- (iii) Certificate of High School Pass Examination in support of date of birth.
- (iv) Migration certificate from the Board/University where the candidate studied last
- (v) College/School leaving certificate from the authority of the College/School where the candidate studied last
- (vi) Conduct certificate from the Principal of the College/School where the candidate studied last
- (vii) Permanent residency/domicile certificate of State concerned
- (viii) Certificate from competent authority, in case admission is sought under reserved category

- (ix) Medical certificate from a Medical Officer not below the rank of Asst. Surgeon in support of physical fitness of the candidate
- (x) Any other documents (as per prospectus/notification) that may be required at the time of admission

2.4 Registration

The first day of the commencement of the semester shall be the date of registration for the students.

2.4.1 Registration of newly admitted students

- i) On admission, a student shall be provided four copies of Registration Cards having different colours, one for the student, one for the Advisor, one for the Dean and one for the Registrar, which shall be filled up and register for the prescribed courses for the first semester. The Registration Cards shall be signed by the student, his/her Advisor, the Assistant Registrar (Acad.) and countersigned by the Dean of the College.
- ii) On admission and registration, the student shall be provided with an Identity Card with his photograph. The Identity Card shall be returned to the College, when the student leaves the College after completion/discontinuation of the course.
- iii) Each newly admitted student shall be given an Admission Number by the Dean of the College concerned and this Admission Number shall continue till allotment of Registration Number by the Registrar.

Note: An Orientation Programme shall be organized by the Dean of the College for the benefit of the newly admitted students immediately after the commencement of the semester.

2.4.2 Registration of continuing students

On successful completion of a semester, the continuing students shall register for the subsequent semester on the date specified in the Academic/Semester Calendar or specifically notified. The following procedure shall be adopted while registering for the second and subsequent semesters of the degree programme:

- i) Submission of no dues certificate from all the Departments and units of the College
- ii) Payment of prescribed fees
- iii) Submission of the prescribed Registration Cards duly filled in and signed by all concerned

2.4.3 Late registration

- i) A continuing student failing to register on the scheduled date of registration may register within 7 working days from the scheduled date by paying late registration fee of Rs. 10/- per day subject to the production of valid reason to the satisfaction of the Dean of the College concerned. This provision is not applicable to newly admitted students.
- ii) Normally students will not be sponsored to participate in any State/National/International level or Inter-University competitions in games and sports, cultural activities or other co-curricular activities during the period of examination and registration. However, in case of exigencies, the students shall be permitted to register within three days of reaching back the College campus after participating in the co-curricular programme without payment of fine.

2.5 Temporary withdrawal of students from the University

2.5.1 A student may be permitted temporary withdrawal from the University by the Registrar on the recommendation of the Dean for one or more semesters on the grounds specified below:

- (i) **Prolonged illness of self:** The student has to submit an application for temporary withdrawal along with a certificate from a Medical Officer, not below the rank of Assistant Surgeon.
- (ii) **Serious accident of the self:** The student has to submit an application along with a medical certificate to the effect that he is unable to attend class for a specified period for availing temporary withdrawal from the degree programme.
- (iii) Death of parent(s) or any other valid reason to the satisfaction of the Dean of the College concerned.

2.5.2 Temporary withdrawal of a student from the University shall not ordinarily be permissible for more than two semesters (one academic year) at a stretch.

2.5.3 A student, after availing the facility of temporary withdrawal shall obtain permission from Registrar for registration and shall register in the semester from which he discontinued along with his junior batch students and take the courses prevailing at the time of registration.

2.6 Advisory system

2.6.1 The Dean of the College shall nominate a teacher as the Advisor for a group of 5 – 10 students within 10 days of admission. The Advisor once nominated shall continue till the students concerned complete their degree programme.

2.6.2 The Advisors shall explain to the students the various Academic Regulations and guide them in planning their academic programmes. They shall also review the academic progress of the students concerned and render them necessary guidance to make up deficiency, if any, to ensure satisfactory progress in study.

2.6.3 The Advisor shall meet the students allotted to him as often as necessary but not less than three times in a semester and ascertain the problem(s) of the students. The students, if face any difficulty, can meet their Advisors as and when necessary and get his assistance and advice for redressal of such difficulties. The Advisor shall serve as a source of two-way communication between the students and the college and bring to the notice of the Dean, the problems of the student(s) that need his attention for redressal.

2.7 Course curriculum and syllabus

2.7.1 The course curriculum and syllabus for each degree programme shall be developed by the Board of Studies and discussed in the meeting of the concerned Faculty. The recommendation of the Faculty shall be placed before the Academic Council and after its approval, the Registrar shall notify the same.

2.7.2 The Head of the Department shall nominate and assign the course to teachers for different courses offered by the Department in a particular Bachelor's Degree Programme and shall monitor the progress.

2.8 Work experience/training programme

The work experience/training programme shall form an integral part of the degree programme. The details of such programmes shall be developed by the faculty concerned and notified by the University after approval of the Academic Council.

2.9 Course credit requirements for different degree programmes

The course credit requirements for B.Sc. Forestry programme shall be based on the model syllabus as prescribed by the ICAR with minor changes to meet the regional needs. The requirement of course credits must be within minimum of 160 and maximum of 165.

Note: 1) Any change in total credits requirement by ICAR shall be applicable.
2) The credits prescribed for Work Experience/Training for different degree programmes shall be within the course credits mentioned above.

2.10 Credit load in a semester

The course credits (Theory + Practical) to be registered in a semester shall not be generally less than 15 and more than 24. The number of courses in the semesters may vary depending upon the credits allotted to different courses. Tutorial classes can be conducted to help the needy students/class as a whole for which there shall not be any credit or compulsory attendance.

2.11 Study tour

2.11.1 Two study tours shall be undertaken for students during the period of each degree programme and shall be organized in the semester breaks between first and second semesters of third year and fourth year.

2.11.2 First study tour shall be confined to the NE Region and second tour shall be outside of the NE Region.

2.11.3 Each study tour shall carry one credit and grading shall be done as Satisfactory(S), if 50% or more marks are secured or Unsatisfactory(US).

2.11.4 The places/institutions of visits shall be of academic interest of the students of the degree programme concerned and shall be decided by a Committee consisting of all Heads of Departments/In-charge of Departments under the Chairmanship of the Dean with due approval from the University.

2.11.5 All students of the year concerned shall participate in the study tour programme.

2.11.6 Each student shall submit a report on study tour within 15 days from the date of return and face a *viva-voce* examination conducted by a panel of three teachers of the College nominated by the Dean.

2.12 Students attendance

2.12.1 Each course teacher shall maintain a student Attendance Register in each semester in the format prescribed by the University.

2.12.2 All students of a degree programme shall be required to attend 80% of the classes held in a course during the semester in order to be eligible to appear in the End-term examination.

2.12.3 The Dean of the College on recommendation of the course teacher and Head of Departments may condone the shortage of attendance up to 5% on valid grounds to his satisfaction.

2.13 Permanent withdrawal/leaving the University

- 2.13.1 On completion of the degree programme, the students shall leave the University after submitting no dues certificates from all concerned – Hostel, Library, College office, all the Departments and teachers i/c of co-curricular activities and other units of the College/campus.
- 2.13.2 A student may get his admission cancelled and leave the University permanently before completion of the degree programme with submission of an application to the Registrar through Dean of the College stating the reason(s) of leaving the University and submitting no dues certificates from all concerned as specified in regulation 2.13.1
- 2.13.3 Refund of caution money, other dues if any, documents submitted at the time of admission, grade card and conduct certificate, etc. shall not be issued back to the student unless he submits no dues certificates from all concerned as mentioned in regulation 2.13.1.

2.14 Cancellation of admission

- 2.14.1 A candidate admitted to UG programme and registered for the courses shall not be permitted to take a drop during the first semester. If the student does so, the admission stands cancelled.
- 2.14.2 If a candidate admitted to U.G. programme fails to complete at least one course with symbol other than “SA” or “F” during the first semester, the admission stands cancelled.
- 2.14.3 Students from Boards/Universities admitted to UG programmes shall produce **migration certificate** from the Boards/Universities, where they had their 10+2 education, failing which their admission shall be invalid and be cancelled.
- 2.14.4 If a student discontinues studies without prior permission of the University, the student’s admission stands cancelled.
- 2.14.5 The admission of any student can be cancelled, on disciplinary grounds.

3. Examination, Evaluation and Grading System

3.1 Examination system

The examination system shall be a combination of 50% internal and 50% external components.

3.2 Examination schedule and weightage

- 3.2.1 The weightage to the theory and practical examinations will be in the same proportion as the theory and practical credits allotted to different courses.
- 3.2.2 Total marks obtained for a course for practical and theory examination shall be added and converted into percentage for working out the grade point. Keeping this in view, the schedule and weightage to different examinations shall be as follows:

Particulars	Course credits									
	2+1		1+1/2+2		1+2		1+0/2+0		0+1/0+2	
	Th.	Pr.	Th.	Pr.	Th.	Pr.	Th.	Pr.	Th.	Pr.
1. Mid-term Exam.	30	--	30	--	30	--	30	--	--	--
2. Quiz*/continuous evaluation	20	30	20	30	20	30	20	--	--	30
3. End-term Exam	50	70	50	70	50	70	50	--	--	70
Maximum Marks	100	100	100	100	100	100	100	--	--	100

* There shall be at least four quizzes in a course.

- **Grade Point**

Ten (10) points grading system shall be adopted with minimum Grade Point Average (GPA) of 5.00 for passing a subject and Overall Grade Point Average (OGPA) of 5.50 for obtaining a degree.

3.2.3 **Calculation of percentage of marks and Grade Point:** Marks secured in a course in theory and practical shall be multiplied by number of theory credit(s) and practical credit(s) of the course respectively and added together. This sum shall be divided by total credits (Theory + Practical) of the said course to get percentage of marks, which shall be divided by 10 to obtain Grade Point (GP).

3.3 Durations of examinations

Mid-term theory Exam	-	1 ½ hours
End-term theory Exam	-	2 ½ hours
End-term practical Exam	-	3 hours

3.4 Appointment of question paper setters and external examiners

3.4.1 The teacher offering the course shall be the examiner for the mid term examination and quizzes, and internal examiner for the end term practical examination. However, under special circumstances, the Dean can nominate another teacher for mid term and / or practical examinations and quizzes.

3.4.2 For the end-term (final) theory and practical examinations, the question setter and external examiner for each course shall be appointment by the Dean of the College concerned as per the following procedures:

- (i) The person(s) nominated for external examinations or question setting should preferably be serving/retired senior teacher(s) of College/University or scientist(s) of reputed Research Institutes.
- (ii) The Head of the Department/Department In-charge shall submit a panel of eight names with detailed addresses to act as question paper setter/external examiner for the end-term examination to the Dean, who shall consolidate the list of all examiners for a semester and shall submit the same to the Vice-Chancellor for approval, at least three months before the date of preparatory break for the final (end-term) examination.
- (iii) The panel after approval shall be valid for all examinations of that particular semester including special and make-up examinations.
- (iv) The question paper setter and answer book evaluator for the end-term theory examination may or may not be the same person, but generally they should be from the panel. However, the Vice-Chancellor may nominate a question paper setter/evaluator from out side the panel also.

3.5 Question pattern and question setting

3.5.1 Question pattern

For theory examinations (both mid-term and end-term examinations), the question paper shall consist of 30 per cent objective, 20 per cent short answer type and 50 per cent descriptive (long answer type) questions.

3.5.2 **Question setting**

- (i) The internal examiner, for the mid-term theory examination, shall submit two sets of questions covering 50 per cent of the syllabus of the course at least 5 days before the commencement of examination to the Dean of the College through the Head of the Department.
- (ii) The external question setter shall submit two sets of questions for the end-term theory examination covering the full course as per syllabus at least 30 days before the commencement of the examination.
- (iii) The Dean, at his discretion, may select one of the two sets of questions for the mid term/end term examinations.

3.6 **Preparatory break**

The students shall be allowed to avail a period of three days as preparatory break prior to the date of commencement of end-term examination. This break shall be part of 15 days earmarked for examinations and shall not be at the cost of instructional days.

3.7 **Conduct of examinations**

- 3.7.1 Both mid-term and end-term examinations shall be conducted centrally and will be notified by the Dean of the College concerned.
- 3.7.2 The dates/period of each examination shall be as per the Academic/Semester Calendar notified by the Registrar. Ordinarily, there should not be any deviation in the dates/period of examination specified in the Academic/Semester Calendar. However, the Dean, to his satisfaction of any valid reason(s), may change the examination schedule to a maximum period of seven days, with intimation to the Registrar.

3.8 **Evaluation of answer books**

- 3.8.1 The answer books of the mid-term examination shall be evaluated by the course teacher (internal examiner) and marks obtained shall be sent to the Dean of the College through the Head of the Department within 15 days of conduct of the examination.
- 3.8.2 The answer books of the quizzes and mid-term examinations shall be shown to the students, who shall return the same to the course teacher after signing the same.
- 3.8.3 The answer books of the end-term theory examinations shall be evaluated by the external examiners after the final practical examination.
- 3.8.4 The external examiners shall submit the answer books after evaluation to the Dean's Office along with the marks list of both theory and practical examinations.
- 3.8.5 The answer books of both the end-term theory and practical examinations shall not be returned to the students and preserved by the Dean for one year from the date of declaration of the results.

3.9 **Assessment of students for Work Experience/Training Programme**

- 3.9.1 The Work Experience/Training Programme, which carries 20 course credits shall be assessed for 17 credits on continuous basis during the semester as satisfactory/unsatisfactory by the

Training-in-charge at the place of training and the **Teacher- in-charge** of the training programme of the College concerned. The remaining 3 credits shall be assessed on 10 points scale for which there shall be an end-term examination.

3.9.2 An Assessment Committee consisting of the following shall be constituted by the Dean of the concerned college and this Committee shall conduct the examination for 3 credits for those students who have earned **satisfactory grade** in 17 credits assessed during the Training Programme.

- | | | |
|------|--|----------|
| i) | Dean or his nominee not below the rank of a Professor/Associate Professor | Chairman |
| ii) | Teacher-in-charge of Work Experience/Training Programme | Member |
| iii) | External Examiner (to be appointed by the Dean with due approval of the Vice-Chancellor) | Member |

3.9.3 Assessment of students for Work Experience/Training Programme for 3 credits shall consist of two components, viz. evaluation of work done report of individual students giving due consideration to the remarks of the Training-in-charge at the place of training and the Teacher-in-charge of the training programme at the college, and *viva-voce* with the allotment of marks as follows:

- | | | |
|-----|------------------|----|
| i) | Work done report | 60 |
| ii) | <i>Viva-voce</i> | 40 |

3.9.4 The Committee shall assess and award the marks to a student on each of the two components of the examination separately.

3.9.5 A student securing less than minimum qualifying grade point shall repeat Work Experience/Training Programme along with his junior batch students without stipend.

3.10 Grading

3.10.1 Grading system

For each course, a student shall be graded on 10 point scale and his GP/GPA/CGPA/OGPA shall be notified.

3.10.2 Qualifying marks (grades) and academic probation

- (i) A student shall secure qualifying marks of 50% separately in theory and practical and earn grade point of 5.00 on 10 point scale in each course to pass the course.
- (ii) The minimum GPA/CGPA/OGPA required for promotion to the next semester/to complete the degree programme shall be 5.50.
- (iii) A student securing 'F' grade in more than two courses in a semester shall not be promoted to the next semester and he/she should be put on academic probation.
- (iv) The student on academic probation shall be allowed to appear a **special examination** in that particular courses in which he/she has failed within 30 days of commencement of the semester.

- (v) The **special examination** shall be conducted centrally and by the external examiner appointed by the Dean out of approved panel in theory only for 50 marks and for a duration of 2 hours. However, if a student has failed in final practical examination then special examination will be conducted involving external examiner.
- (vi) The results of the **special examination** shall be declared normally within 15 days of the examination and if the student secures 50% or more marks separately in theory and practical in failed course(s) (one or two courses as the case may be) he/she shall be declared out of probation.
- (vii) In case, if a student who has failed in one course and he/she is unable to clear the course in special examination, he/she shall continue his/her present semester and can register for failed course with the junior batch students as and when it is offered. Similarly, if a student who has failed in two courses and clears one course and fails in another, he/she shall continue his/her present semester and can register for failed course with the junior batch students as and when it is offered.
- (viii) If a student kept on academic probation as has failed in two courses and again fails in both the courses in **the special examination**, he/she shall be reverted back and his/her registration for the semester shall be cancelled and he/she shall be entitled for refund of entire semester fees.

3.10.3 Detention of students

- (i) A student securing less than 5.50 GPA/CGPA at the end of any semester shall not be allowed to go to the next semester till he clears the semester.
- (ii) A student securing CGPA of 5.50 or more but having 'F' grade in more than two courses in a semester shall be detained.
- (iii) A student falling short of attendance and unable to clear the semester shall be put on academic probation.
- (iv) A student on academic probation if fails to secure 50% or more marks both in theory and practical section in **special examination** shall be detained.

3.10.4 Registration of the detained students

- (i) A student detained in a semester because of failing to meet minimum scholastic requirements shall re-register for the same semester in the next academic year after paying the semester fees. Such student shall have to register for all the courses of the semester being offered in that semester irrespective of the grade points obtained by him in any course earlier which shall be forfeited.
- (ii) Students detained for shortage of attendance in a semester (except that in first semester) shall be allowed to take re-registration for the same semester in the next academic year after paying the semester fees.
- (iii) Students detained in first semester due to shortage of attendance or failure to clear at least one course after appearing in the examination shall not be allowed to re-register and their admission shall stand cancelled.

3.11 Arrangement of sick bed

On recommendation of the College Medical Officer, a student may be permitted by the Dean to appear any examination on sick bed at the medical unit of the College.

3.12 Absence from examination

3.12.1 Absence from mid-term/end-term examination

A student remaining absent from mid-term/end-term examination of one or more than one courses on the ground of his illness and hospitalization or death of his parent(s)/spouse, may be allowed to appear for special examination by the Dean of the College on recommendation of the student's Advisor and course teacher, provided that:

- i) the student(s) concerned submits application to the Dean within three days of the missed examination
- ii) Submits medical certificate in case of his own illness from the College Medical Officer
- iii) Gives sufficient proof for other reasons of his absence indicated above

3.12.2 Manner of make-up examination

- (i) The student missing the mid-term examination has to appear in the make up examination within 15 days from the date of missed examination. The date(s) of make up examination shall be notified by the Dean of the College concerned and the student(s) shall have one chance for such examination.
- (ii) The student(s) missing the end-term examination shall appear in the make-up examination of the course(s) concerned within 15 days of commencement of the next semester as notified by the Dean of the College concerned.
- (iii) Such student will have only one chance to appear in the make up examination and in case he fails to appear to the examination on the stipulated date(s) or fails in the examination, he shall be permitted to take up **special examination**.
- (iv) In end-term make-up examination, external system of examination and evaluation shall be adopted for both theory and practical.
- (v) The marks secured by the student(s) in the make-up examination shall be counted, along with the marks obtained in other examination(s) for computing grade point in the course(s) concerned.

3.13 Performance classification

A student will be eligible for award of degree provided he has passed all the courses and secured minimum OGPA of 5.50 at the end of final semester including the Work experience/Training programme. The successful candidates of a degree programme shall be awarded the degree with the following classes and distinction based on their performance:

OGPA range	Performance description
8.50 and above	I class with Distinction*
7.50 to 8.49	I class
5.50 to 7.49	II class

* Students securing OGPA of 8.50 or more without being on academic probation and without appearing to any repeat examination in any semester and completing the degree programme in the minimum stipulated duration shall be awarded "First class with Distinction". A student getting OGPA of 8.50 or more, but not fulfilling any one of these requirements shall be awarded only First Class.

3.14 University Gold Medal

- 3.14.1 University Gold Medal shall be awarded to a student of each degree programme who secures the first rank among the successful candidates with Overall Grade Point Average of not less than 7.50/10.00 in the said degree programme.
- 3.14.2 In order to be eligible for the award, a graduating student should have completed all requirements for the degree consecutively within the minimum period of time prescribed for the degree without repeating any examination/course and /or obtaining “F” grade in any course and /or by improving grade in any course.
- 3.14.3 A student who had been on academic and /or conduct probation at any time during his residency in the Central Agricultural University shall not be eligible for the award of the University Gold Medal.
- 3.14.4 If more than one student completing the graduation in a particular programme secures the same OGPA, the younger/youngest one shall be awarded the Gold Medal.
- 3.14.5 The University Gold Medal shall be awarded to all eligible passed out students of the University from its inception.

3.15 Transcript and Provisional Certificate

- 3.15.1 On declaration of the final semester results of a degree programme, the transcript containing semester-wise detailed academic attainments along with final OGPA of individual students shall be prepared by the College concerned.
- 3.15.2 The transcripts, thus prepared for all the students in the University and duly approved shall be transmitted to the respective Deans. The Dean of the College shall issue the final transcript to the students on receiving necessary fee for the purpose and no dues certificate.
- 3.15.3 Pending approval from the Academic Council, Provisional Transcript can be issued by the Dean of the College concerned.
- 3.15.4 A provisional degree certificate in the prescribed form shall also be issued to the students on payment of fee prescribed for the purpose and receiving no dues certificate, under the signature of the Registrar.

3.16 Convocation and degree certificate

- 3.16.1 Annual convocation for award of degrees shall be held in accordance with the provisions made in the Act and statutes of the University and as per decision of the Academic Council duly approved by the Board of Management.
- 3.16.2 The Registrar shall issue a notification each year prescribing the last date for receiving application for conferment of degree during ensuing convocation from the candidates, who have completed their degree requirements by that year.
- 3.16.3 Students completing the degree programme successfully and exhibiting good conduct during the course of their study as certified by the Dean of the College shall submit application to the Registrar through the Dean for admitting to the degree in person or *in absentia*.
- 3.16.4 The convocation fee shall be collected at the time of issuing provisional degree certificate.

3.16.5 The students declared eligible for a particular degree and duly approved by the Academic Council shall be admitted to the said degree and the degree certificate in the prescribed form shall be presented to them in the convocation to be held once in a year.

3.16.6 The graduates who fail to apply for admittance to the degree either in person or *in absentia*, shall also be admitted to the degree concerned, if they are eligible otherwise and shall be issued the degree certificate, after receiving a written request from the graduates concerned along with the prescribed fee.

3.17 Amendment or cancellation of result

If it is found that the result of a candidate has been vitiated by malpractice, fraud or other improper conduct, whereby the student has been benefited, the Academic Council and the Board of Management have the powers at any time, notwithstanding the award of the degree to amend the result of such candidate including cancellation of the result and to pass such order as may deem fit.

4. Fees, Scholarships and Remuneration for Examination Work

4.1. Fees

4.1.1 For new admission

- (a) Students selected for admission to the first semester of first year shall pay the admission fee and all other one time fees, and semester fees on the day of admission. The students shall be allowed to register only after payment of all prescribed fees circulated by the University from time to time after taking approval from the Academic Council.
- (b) The students discontinuing their studies after admission/registration shall not be eligible for refund of any fees other than the caution money deposits.
- (c) Caution money deposited by student shall be refunded at the time of leaving the college after producing no dues certificate.

4.1.2 For continuing students

- (a) The students registering to the second and subsequent semesters shall pay the prescribed semester fees on the day of registration, failing which registration will not be allowed.
- (b) Late registration of the continuing students is governed by the regulation given at 2.4.3.
- (c) At the time of payment of semester fees for registration to the second and subsequent semesters, the students shall produce his Identity Card and no dues certificate from all concerned.
- (d) A student registering with junior batch students shall pay the semester fees applicable to the junior batch in that particular semester in which he registers.

4.1.3 Miscellaneous fees

Students shall pay fees for various certificates and other related fees as prescribed by the University.

4.2 Merit scholarship

Students shall be awarded the merit scholarship as per the procedure given below:

- 4.2.1 One scholarship shall be awarded for each year of UG study in a College @Rs. 1000 per month based on the merit.
- 4.2.2 For first year, the scholarship shall be awarded to the students based on their performance at (10+2) examination. To be eligible a students should have secured at least 60% marks in aggregate in the relevant subjects as defined under Admission requirements clause 2.1.1(i).
- 4.2.3 In case of a tie, the scholarship shall be awarded to the younger/youngest student, considering the date of birth, as recorded in the certificate of High School pass examination.
- 4.2.4 The scholarship shall be sanctioned for one academic year including semester break from the date of commencement of the first semester/date of registration by the concerned student.
- 4.2.5 For second and subsequent years of study, the scholarship shall be decided on the basis of CGPA obtained at the end of 1st year, 2nd year and 3rd year, respectively.
- 4.2.6 There shall be an Award Committee at the College consisting of Dean as the Chairperson, all Heads of Departments/In-charge of Departments of College as members and Assistant Registrar as Member Secretary. The Committee shall prepare a panel of names of eligible candidates and make suitable recommendation to the Registrar for getting the approval of the competent authority and notification there on.
- 4.2.7 The Colleges shall make the recommendation within two weeks of the commencement of the next semester/next academic year and the University shall notify the final award of the scholarship within four weeks of the commencement of the next semester/next academic year.
- 4.2.8 The merit scholarship shall be awarded to the students from the academic year 2007-08 including those who are on the role of the University in the second and subsequent years of study.
- 4.2.9 The student who has obtained 'F' grade/repeated course(s) or who has been placed on academic/conduct probation will not be eligible for merit scholarship.

5. Maintenance of Discipline

5.1 Authority for maintenance of discipline

The Dean of the College shall deal with all the acts of students' indiscipline in the College campus including hostels, libraries, play grounds or any other place in the campus.

5.2 Disciplinary Board/Committees

There shall be a Disciplinary Board at University level and a Disciplinary Committee at College level as detailed below:

5.2.1 Disciplinary Board

- | | |
|--|------------------|
| i. Director of Instruction (Ex-Officio) | Chairman |
| ii. Two Deans nominated by the Vice-Chancellor | Members |
| iii. Registrar (Ex-Officio) | Member Secretary |

Note : i) Dean of the College concerned shall be Co-opted as a Member.

- ii) The term of the Disciplinary Board shall be for a period of two years from the date of notification.

5.2.2 **Disciplinary Committee**

- i) Dean of the College Chairman
- ii) Three senior most Heads of the Dept./
In-charge of Departments nominated
By the Dean Member
- iii) Students Welfare Officer Member Secretary

- Note: : i) If the case pertains to academic issues, Asstt. Registrar (Academic) shall be co-opted as a Member
- ii) If the matter pertains to hostel, concerned Hostel Warden shall be co-opted as a Member.
 - iii) The term of the Disciplinary Committee shall be for a period of two years from the date of notification.

5.3 **Acts of indiscipline**

5.3.1 All students of the University shall maintain discipline and good conduct, and shall not indulge in such activities, which may cause breach of discipline in the College / University campuses.

5.3.2 Generally the following activities shall constitute the acts of indiscipline:

- (1) Ragging of any type, either physically or mentally to fellow student(s) in any place of the College campus including hostels, library, playground, etc.
- (2) Damaging or threatening to damage any property of the College/University.
- (3) Misbehaviour/disrespect to officers, teaching and non-teaching staff of the College/University
- (4) Keeping or using intoxicants, drugs and liquor or persuading others for consumption of liquor, drug etc.
- (5) Any form of gambling
- (6) Use of University/College or hostel premises for the purposes other than meant for without permission of the competent authority
- (7) Demonstrations in any form including processions, recourse to violence, assault, rioting, strike, hunger strike etc.
- (8) Keeping fire-arms/weapons in the hostel
- (9) Disturbing other students in their studies
- (10) Breach of law of the country or state and rules and regulations of the University
- (11) Any other act of student(s), which may be considered as an act of indiscipline by the College/University authorities

5.4 **Award of punishment for breach of discipline**

For breach of discipline, the University may impose any of the following punishments or combination of punishments on any student(s) on the recommendations of the Disciplinary Committee / Disciplinary Board:

5.4.1 **Monetary fine**

The Dean of the College can impose monetary fine up to Rs. 500/- to any student involved in an act of indiscipline.

5.4.2 **Reprimand on record**

This shall consist of warning to the defaulting student(s) indicating the particular indiscipline committed and not to repeat any act of indiscipline in future. This shall be recorded in the student's permanent record/file maintained in the College and the University.

5.4.3 **Conduct probation**

This shall consist of placing the student on conduct probation with a warning that one more incident of act of indiscipline might lead to his expulsion from the University. The conduct probation shall be noted on the permanent record/file of the student concerned and shall be in-force for one year from the date of communication to the student(s). During the period of conduct probation, the student shall not be allowed:

- (i) to represent the College/University in games, sports, cultural programmes etc., outside the University
- (ii) to hold responsibility as office bearer in Students Council/any students body, and
- (iii) any scholarship/freeship that might be sanctioned by the University/ICAR

5.4.4 **Temporary expulsion**

- (i) The student(s) shall be expelled from the University for a minimum period of one semester and he shall leave the University including hostel immediately. The period of temporary expulsion shall be entered in the permanent record of the student(s).
- (ii) The students(s) awarded with the punishment of temporary expulsion shall be readmitted to the University after expiry of the expulsion period on his written request and undertaking that he shall not commit any act of indiscipline in future.

5.4.5 **Permanent expulsion**

The student shall be permanently expelled from the University and shall be debarred from re-admission to the University.

5.4.6 **Rustication**

The student shall be rusticated from the University and his punishment shall be entered in the permanent record, semester report and transcript of the student, who shall be debarred from re-admission to the University.

5.4.7 **Closure of College/cancellation of semester/academic year**

In case of any en-mass organized and prolonged indiscipline by the students of a College/Colleges, the Dean shall make day-to-day report to the University. If the agitation continues for a week or more, the Dean in consultation with the Disciplinary Committee shall make suitable recommendation to the University, which may decide on the following course of action:

- (i) Closure of the College *sine die*
- (ii) Cancellation of a semester or academic year for any class of the College or of the College as a whole.

5.4.8 The punishment awarded under clauses 5.4.5, 5.4.6 and 5.4.7 may be communicated to the Academic Council and Board of Management at the earliest possible opportunities.

5.5 Appellate authority

The Vice-Chancellor shall be the Appellate Authority. If an appeal is made to him, he may reduce/enhance the punishment, after review of the case. The decision of the Vice-Chancellor shall be final and binding on the student(s).

5.6 Discipline in examinations

5.6.1 A student appearing in the mid-term or end-term examination shall carry his **Identity Card** to the examination hall and shall show the same to the invigilator, teacher in-charge of examination and Dean of the College, when asked for.

5.6.2 The examination halls shall be opened 15 minutes earlier on the first day and 10 minutes on subsequent days before the commencement of the examinations. A student arriving the examination hall 15 minutes after commencement of the examination shall not be allowed to appear for the examination concerned.

5.6.3 The examinees shall occupy their respective allotted seats at least 5 minutes before the scheduled examination time.

5.6.4 No examinee shall be allowed to go out of the examination hall within 30 minutes from the time of commencement of examination.

5.6.5 The examinees shall follow strictly the instructions written on the cover page of the answer books, which will be supplied by the College authorities duly authenticated. If additional sheets are required, those shall also be authenticated by the college authority before issuing to the examinee. Unused pages from the answer book/additional sheets should not be removed.

5.6.6 No examinee shall take any book, notes, unauthenticated sheet of papers, Mobile Phone, or any other incrimination material to the examination hall.

5.6.7 Unfair means

The following activities of the examinees in the examination halls shall be considered as adoption of unfair means:

- (i) Helping other examinees or getting help from others verbally, through gestures or by any other means
- (ii) Making an appeal to the examiner for help in the answer book or trying to influence the examiner by any means
- (iii) Possession and/or use of any incrimination material(s)
- (iv) Creating disturbance for other examinees by consulting or attempting to consult with them, offering his answer books/incrementing materials to others or receiving the answer books/incrementing materials from others
- (v) Misbehaviour with the invigilator(s) in the examination hall or non-cooperation with him in discharging his duties

5.6.8 Disciplinary actions for adopting of unfair means in examinations

The Dean of the College concerned shall deal with the cases of adopting of unfair means in examinations (clause 5.6.7) as per the provisions of clause 5.4 pertaining to Award of punishment for breach of discipline as per the following procedure:

- (i) The invigilator concerned shall seize the answer book along with incriminating materials, if any, and report the case(s) of unfair means adopting along with a written statement of the student concerned and incrimination material (if any) to the Dean of the College on the day of occurrence of the incident.
- (ii) In case the defaulting student refuses to give a written statement even after persuasion by the invigilator, he shall be asked to record in writing his refusal to give a statement. If the student refuses to do even that, the fact of refusal, shall be recorded duly witnessed at least by another invigilator/teacher and submitted along with answer book and incriminating material (if any) to the Dean of the College. The student shall be sent out of the examination hall.
- (iii) The Dean shall call for explanation from the student concerned and on receiving the written explanation, he shall conduct an inquiry by the Disciplinary Committee of the College.
- (iv) In the process of enquiry, the student shall be given full opportunity for his defence through personal appearance.
- (v) The award of punishment shall be in accordance with the severity of the case and shall be in accordance with Award of punishment mentioned under clause 5.4. However, if a student is found indulging in a malpractice in mid-term examination, he shall be expelled from the examination hall for that particular course following the procedure and he shall be declared as failed in that course.

If a student is found indulging in malpractice in an end-term examination, he shall be declared as failed in all courses registered in that semester and he shall be expelled from the College for the next semester.

- (vi) The Dean shall take appropriate action on recommendation of the Disciplinary Committee duly approved by the Vice-Chancellor.

6. Savings

- 6.1** No regulation made by the Academic Council, concerning the undergraduate studies shall limit or bridge the powers of the Academic Council to deal with any case(s) of any student or students in such a manner as it may appear to be just and equitable.
- 6.2** Any modification in these regulations made from time to time by the Academic Council would be effective from the dates as may be decided by the Academic Council to all the students, who are on rolls on that day or subsequent dates, as decided by the Academic Council.
- 6.3** In the event of any difficulty arising at any time in the implementation of these regulations or in interpretation thereof, the decision of the Academic Council shall be final and binding on all concerned.
- 6.4** In case of any emergency, the Chairman of Academic Council shall have the authority to take appropriate decision that shall be placed before the next Academic Council meeting for information.

B. CURRICULUM AND SYLLABUS FOR UNDER GRADUATE PROGRAMME IN FORESTRY (AS PER FORTH DEANS COMMITTEE ON AGRICULTURAL EDUCATION IN INDIA)

1. List of Department-wise Courses in Undergraduate Forestry Programme

Silviculture & Agroforestry		Credits
I.	Principles & Practices of Silviculture	4(3+1)
II.	Silviculture of Indian Trees	3(2+1)
III.	Agroforestry Systems and Management	3(2+1)
IV.	Plantation Forestry	2(1+1)
V.	Silvicultural systems	2(2+0)
VI.	Nursery Management	2(1+1)
VII.	World Forestry System	2(2+0)
VIII.	Livestock Management	2(1+1)
IX.	Forest Mensuration	3(2+1)
X.	Environmental Science	3(2+1)
XI.	Fundamentals of Horticulture	2(1+1)
	Total	28(19+9)
Forest Biology & Tree Improvement		
I.	Forest Ecology, Biodiversity & Conservation	2(1+1)
II.	Dendrology	3(2+1)
III.	Principles of Tree Improvement	3(2+1)
IV.	Tree Seed Technology	2(1+1)
V.	Fundamentals of wild Life	2(2+0)
VI.	Forest Pathology	3(2+1)
VII.	Wild Life Management	3(2+1)
VIII.	Forest Entomology and Nematology	3(2+1)
	Total	21 (14+7)
Forest Products & Utilization		
I.	Wood Anatomy	2(1+1)
II.	Logging & Ergonomics	2(1+1)
III.	Wood Products & Utilization	2(1+1)
IV.	Wood Science & Technology	3(2+1)
V.	Ethnobotany	3(2+1)
VI.	Utilization of Non-Timber Products	3(2+1)
VII.	Medicinal & Aromatic Plants	3(2+1)
	Total	18(11+7)
Natural Resource Management		
I.	Principles of Hydrology, Soil and Water Conservation	3(2+1)
II.	Soil Survey, Remote Sensing and Wasteland Development	3(2+1)
III.	Fundamentals of Geology and Soil Science	2(1+1)
IV.	Rangeland Management	3(2+1)
V.	Forest Management, Policy and Legislation	3(2+1)
VI.	Agrometeorology	2(1+1)

VII.	Forest Business Management	2(1+1)
VIII.	Marketing and Trade of Forest Produce	3(2+1)
IX.	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)
X.	Chemistry and Fertility of Forest Soils	3(2+1)
XI.	Forest Engineering	2(1+1)
	Total	28(17+11)
Basic Sciences & Humanities		
I.	Plant Biochemistry and Biotechnology	3(2+1)
II.	Principles of Cytology and Genetics	2(1+1)
III.	Entrepreneurship Development and Communication Skills	3(2+1)
IV.	Elementary Statistics and Computer Application	3(2+1)
V.	Principles of Plant Physiology	2(1+1)
VI.	Tree Physiology	3(2+1)
VII.	Introductory Forest Economics	2(2+0)
VIII.	Forest Tribology and Anthropology	2(2+0)
IX.	Fundamental of Extension Education	2(1+1)
X.	Structural Grammar and Spoken English (NC)	2(1+1)
XI.	Physical Education (NC)	1(0+1)
XII.	NCC/NSS (NC)	1(0+1)
Deficiency Courses		
I.	Introductory Botany (Math Group)	3(2+1)
II.	Basic Mathematics (Biology Group)	3(3+0)
	Total	28(20 +8)

Summary of Semester wise Credit Distribution

Sr.	Activity	Credits
I.	Course Work upto VI Semester	123 (Minimum)
II.	FWE/Hands-on-Training in VII Semester	20
III.	Multidisciplinary Courses/Vocational Training in VIII Semester	20
	Total	163 minimum

Semester VII and VIII

Forestry Work Experience: Total duration of the programme should be 20 weeks and shall be conducted in VII semester (or VIII semester depending on regional suitability). First 4 weeks of the programme shall focus on village attachment and shall be followed by 10 weeks of intensive attachment with State Forest Departments. For 4 weeks students shall be placed in forest based industries for hands-on training. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation. The details of the course are as follows:

Sr.	Course Title	Credits	Days
1	Forestry Work Experience-(Socio-Economic Surveys -Village Attachment)	0+4	28
2	Attachment with State Forest Department for Forestry Operations	0+10	70
3	Industrial Placement	0+4	28
4	Report Writing and Presentation	0+2	14
	Total	0+20	140

2. Syllabus

2.1 Silviculture & Agroforestry

I. Principle 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. Bioclimate 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.

II. 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 broad-leaved tree species of India. Conifers: *Abies pindrow*, *Picea smithiana*, *Cedrus deodara*, *Pinus roxburghii*, *Pinus wallichiana*, *P. gerardiana* and *Juniperus macrospora*. Broad leaved species: *Tectona grandis*, *Shorea robusta*, *Acacia spp.*, *Dalbergia sissoo*, *D. latifolia*, *Quercus spp.*, *Robinia pseudoacacia*, *Alnus spp.*, *Anogeissus spp.*, *Populus spp.*, *Eucalyptus spp.*, *Casuarina equisetifolia*, *Terminalia spp.*, *Santalum album*, *Swietenia mahagoni*, *Albizia spp.*, *Prosopis spp.*, *Pterocarpus santalinus*, *Azadirachta indica*, *Diospyros melanoxylon*, *Madhuca indica*, *Leucaena leucocephala* and Bamboos.

Practical: Study of species composition in surrounding areas. Study of morphology and phenology of tree species growing in the area. Study of artificial regeneration of Pines, Bamboo, Oak, *Dalbergia 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.

III. 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 agro-climatic 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 of agroforestry practices in local/ adjoining areas.

IV. 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 seeding. 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.

V. 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.

VI. Nursery Management 2(1+1)

Propagation concept, definition, methods and importance. Site selection, planning and layout of nursery area. Types of nursery, types of nursery beds, preparation of beds. Pre-sowing treatments. Methods of seed sowing. pricking. watering methods, weeding, hoeing, fertilization, shading, root culturing techniques, lifting windows, grading, packaging. Storing and transportation. Type and size of containers. Merits and demerits of containerized

nursery. Preparation of ingredient mixture. Vegetative propagation techniques - macro and micropropagation. Study of important nursery pests and diseases and their control measures. Nursery practices for some important tree species.

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

XII. World Forestry Systems 2(2+0)

Geographical distribution of forests and their classification. Critical examination of the world forest 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.

VIII. 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 hay, silage and leaf meal.

IX. 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, callipers 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, 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.

X. Environmental Science 3 (2+1)

Environment: introduction, definition and importance. Components of environment - interactions with organisms. Global and Indian environments - 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/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques.

XI. Fundamentals of Horticulture 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.

2.2 Forest Biology and Tree Improvement

I. 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.

II. 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.

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*, *Guttiferae* and *Liliaceae*; *Moraceae* and *Poaceae*; *Meliaceae*, *Elaeagnaceae* and *Salicaceae*; *Leguminosae* and *Apocynaceae*; *Combretaceae*, *Lyttracae*, *Myrtaceae* and *Santaleaceae*; *Asteraceae*, *Ebenaceae*, *Sapotaceae* and *Verbenaceae*; *Euphorbiaceae*, *Pinaceae*, *Cupressaceae*, *Taxaceae*.

III. 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.

IV. Tree Seed Technology 2 (1+1)

Introduction – Seed and its importance – afforestation activity and seed requirements in India and NE region. 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.

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

V. 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 NGO's. BNHS, WWF, Indian Board for wildlife, CITES. Biological basis of wildlife management. Basic requirements of wildlife – food, water, cover and space, limiting factors. Wildlife ecology : Relevance of basic ecological concepts such as food-chain, food-web, ecological pyramids, habitat, ecological niche, carrying capacity, density, prey-predator relations and population dynamics.

VI. 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. Broad classification of different pathogens causing tree diseases. General characteristics of fungi, bacteria, viruses, phytoplasma and phanerogams. Important characters of ascomycetes and basidiomycetes. Important orders and families of Hymenomycetes with a special reference to Aphyllophoraceae 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, subabul and *Acacia*); Symptoms, etiology and control of disease/disorders of important tree species (jack, *Lagerstroemia*, *Anogeissus* and *Embllica*); 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.

VII. 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 interspersions 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 *ex-situ* conservation, conserving biodiversity. Politics-socioeconomics, role of education and extension.

Practical: Field/laboratory studies of distinct and characteristic 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.

VII. 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 spp., 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.

2.3 Forest Products and Utilization

I. 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.

II. 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 operations in a phase wise manner; Application of felling rules in the forests for felling of standing trees at different localities; Instructions regarding maintenance of various records and registers in logging operations; Conversion of felled trees into logs, poles, firewood, pulpwood etc.; Measurement of logs, poles and firewood in forests and maintenance of records in relevant registers; Minor and other types of transport practicable at felling sites; Final transport,

information regarding transit permits for various types of forest produce; Visit to local dumping yard (timber depot) to trace the logs delivered from different forest sites; Sorting of logs, poles and firewood in the depots according to species, quality, length and girth classes; Stacking and stock checking of different logs, poles and firewood in the depots so as to confirm that all the converted materials in the forests have reached their destination; Lotting of the stacks for display and final disposal; Recording of the lots for auction sale. Final disposal of the material; Visit during the auction sale in the government timber depots; Preparation of ergonomic check lists.

III. Wood Products and Utilization 2(1+1)

Pulp and paper industry. Introduction and raw material; pulping-mechanical, chemical, semi-chemical 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.

IV. 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.

V. 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).

VI. Utilization of Non-Timber Forest Products 3(2+1)

Introduction, methods of collection, management and importance of Non-Timber Forest Products (NTFP). Fodders (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.

VII. Medicinal and Aromatic Plants 3 (2+1)

History, scope, opportunities and constraints in the cultivation and utilisation 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. Medicinal Plants : pepper, cardamom, clove, ginger, turmeric, betelvine, periwinkle, *Rauwolfia*, *Dioscorea*, isabgol, *Ammi majus*, belladonna, *Cinchona*, pyrethrum and other species relevant to local conditions. Aromatic Plants : Citronella grass, *lebus* grass, sweet flag (bach), lavender, geranium, patchouli, bursera, *Mentha*, muskdana (musk mallow), *Ocimum* and other species relevant to the local conditions. Endangered medicinal and aromatic plants of India and their conservation. Study of chemical composition of a few important medicinal and aromatic plants, their extraction and use. Therapeutic and pharmaceutical uses of important species.

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

2.4 Natural Resource Management

I. 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, interception by stemflow through fall, 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.

II. 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, landuse classes and planning. Aerial photography and remote sensing-definition, meaning, scope, merits and brief history. Electromagnetic spectrum; radiations, differential reflections by surfaces, active and passive remote sensing, earth observation satellites. Equipment and materials-aerial bases, cameras, filters, stereoscopes, computers, radars. Photogrammetry: Vertical and oblique photography. Photographs and images, scales, resolution, photo interpretation, photogrammetry, image analysis, mapping. Agencies involved in remote sensing and acquiring information from them. Remote sensing; principles, uses in forestry, status monitoring, fire, vegetation/cover classification and mapping, species identification, height and volume – estimation. Identification of tree species and their form stand delineation. Interpretation of land forms and soils; use of micro-level survey of farm forests, large scale photos in forest inventory, site selection. Imagery and image analysis – video satellite, computer and radars. Geographic Information systems-Computer softwares used. Characterization of wasteland, present status and extent of non-arable 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.

III. 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-Stock's law-assumption-limitations-textural classes-use of textural triangle, absolute specific gravity-definition-apparent specific gravity/bulk density-factors influencing-field bulk density. Relation between BD.PD-Practical Problem. Pore space-definition-factors affecting capillary and non-capillary porosity-soil colour-definition-its significance-colour variable-hue, value, chroma, Munsell colour chart-factors influencing-parent material-soil moisture-organic matter, 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.

IV. 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.

V. 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. Evenaged and unevenaged models. Estimation of growing stock, density, quantity and increment. Yield regulation – general principles of even aged and unevenaged forest crop. Yield regulation based on area, volume, area and volume, increment and number of trees. Working Plan – definition, objects and necessity. 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. Himachal Pradesh 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 methods for yield regulation. Study the various units adopted in the forest management. Study of various records and forms maintained in the office of the RFO with regard to management of forests under their control. Study of procedure for seizure of property. Visit to Forest Department and courts to observe penalty procedures. Preparation of first information report and enactment report. Study of working plans of the forests and to prepare the working plan for one of the area in the range.

VI. 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 normals for crops. Agroclimatic zones of India and Himachal Pradesh. 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 Nauni. Lay out of an agromet observatory and types. Measurement of wind and evaporation. Measurement of sunshine hours. Measurement of soil temperature and dew.

VII. Forest Business Management 2(1+1)
(Curricula to be developed)

VIII. 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. Market inefficiencies in the trade of forest produce and measures to check the same. Fundamentals of international trade. Domestic and international trade in timber and non-timber forestry outputs. Demand forecasts – concept and methods. WTO – background, structure, functions and decision making process. IPRs and their implications for forestry and allied sectors in the country.

Practical: 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.

IX. 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. Basics of marginal analysis and its applications in economic analysis of forestry production systems. Basics of Linear Programming. Financial and economic rotations. Fundamentals of project planning and evaluation and network scheduling techniques. Valuation of timber and non-timber forest products.

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

X. 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 phosphorus, sulphur and micro nutrients. Mycorrhizae: types, biology and importance with specific relevance to tree crops and mobilization of phosphorus and micro-nutrients. Rhizosphere and phyllosphere concept.

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 (HCO_3^- , CO_3^{2-} , Cl^- , SO_4^{2-}); Determination of available N, P & K contents of soil; Basic sterilization techniques; culturing and maintenance of micro organisms occurring in soil; Staining methods; Study of decomposition of forest litter by CO_2 – evolution method; Estimation of nitrification rate in soil; Isolation of legume bacteria and Azotobacter; Preparation and inoculation techniques for mycorrhizae and biofertilizers.

XI. 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 slopy 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. Theodolite and its uses. 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, spurs, 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

XII. Organic Farming 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, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides 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.

2.5. Basic Sciences and Humanities

I. Plant Biochemistry and Biotechnology 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 structure-essential 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/cofactors-carbohydrate 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 bio-technology. Application of plant tissue culture in plant improvement Micropropagation: Principles and application in forestry trees and medicinal plants; meristem culture; plant cell and suspension cultures; organogenesis and regeneration *in vitro* and somaclonal variations; genetic engineering techniques; transgenic plants with case studies of tree species to diseases, 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 acids-paper 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.

II. Principles of Cytology and Genetics

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.

III. Entrepreneurship Development and Communication Skills 2 (1+1)

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / 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. Social Responsibility of Business. 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, imprompt 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.

IV. Elementary Statistics and Computer Application 3(2+ 1)

Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles and quadrilles, for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poisson and normal distributions, sampling, basic concepts, sampling vs. complete enumeration parameter and statistic, sampling methods, simple random sampling and stratified random sampling. Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of Mendalian ratios. Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient. Experimental Designs: Basic concepts, completely randomized design, randomized block design, latin square designs, factorial experiments, basic concepts, analysis of factorial experiments up to 3 factors – split plot design, strip plot design, long term experiments, plot size, guard rows. Computer application: Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows 95, introduction to programming languages, BASIC language, concepts, basic and programming techniques, MS Office, Win Word, Excel, Power Point, introduction to Multi-media and its application. VISUAL BASIC-concepts, basic and programming techniques, introduction to Internet.

Practical: Construction of frequency distribution table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrilles, and median for row and grouped data, coefficient of variation, 't' test for independent, will equal and unequal variants, paired 't' test, chi-square test for contingency tables and theoretical ratios, correlation and linear regression. Studies on computer components – BASIC language, VISUAL BASIC, programming techniques, MS Office, Excel, Power Point.

V. Principles of Plant Physiology 2(1+1)

Water relations in plants: role of water in plant metabolism, osmosis, imbibition, diffusion, water potential and its components, absorption of water, mechanisms of absorption, ascent of sap. Stomata, structure, distribution, classification, mechanisms of opening and closing of stomata, guttation, transpiration, 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. Photohormones, 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, Separation of xanthophyll, Chlorophyll in plants, Studying the activity of catalase, Detection of phenols in plants, Studying the plant movements, Root initiation in cuttings.

VI. 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 environment. Branching in isolated plants. Monoculture and mixed tree communities. LAI, Photosynthetic efficiency and respiratory losses, source-sink 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.

VII. Introductory Forest Economics 2(2+0)

Nature and scope of economics and its relationship with other sciences. Theory of consumption. Marshallian theory of utility, equimarginal utility and Hicks-Allen approach for determining consumer equilibrium. Concept and types of demand, laws of demand and factors affecting demand of commodities. Elasticity – its kinds, measurement and factors affecting it. Factors of production, their definition and characteristics, Law of diminishing marginal returns. Supply – definition, law and elasticity. Market – its classification and price determination under different market situation. Introduction to distribution theories with particular reference to Ricardian Theory of Rent. Marginal productivity theory of wages, Liquidity preference theory of interest, Marginal Productivity theory, risk taking and uncertainty bearing theories of profit. National Income and its concepts. Concept and types of inflation.

VIII. 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. Race – concept criteria of racial classification, major races of India and the world. 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 and cultural change – its meaning and characteristics and difference between social & cultural change and recent changes among the tribals. 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. History of tribal welfare and administration - the Constitutional safeguards for the scheduled tribes. Policies, plans and programmes of tribal development and their implementations. The role of anthropology in tribal development.

IX. Fundamentals of Extension Education

2(1+1)

Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Forestry extension: process, principles and selected programmes of leading national and international Forest Institutes. People's participation in forestry programmes. Motivation of women community, children, youth and voluntary organizations for forestry extension work. Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) National Demonstration (ND), Front Line Demonstration (FLD) Krishi Vigyan Kendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Communication: meaning, definition, elements and selected models. Audio – visual aids: importance, classification and selection. Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of Human Resource Development (HRD), rural leadership.

Practical: Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/Mahila Mandal, Village Panchayat, State Dept. of Forests/All India Radio (AIR). 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 & 35 mm slide projector, transparencies. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.

X. Structural Grammar and Spoken English

2 (1+1)

Applied Grammar: Introduction to Word Classes. Structure of the Verb in English. Uses of Tenses. Study of Voice. Use of Conjunctions and Prepositions. Sentence Patterns in English. Spoken English: Conversations of Different Situations in Everyday Life. The Concept of Stress, Stress Shift in Words and Sentences. Words with Silent Letters and their Pronunciations. The Basic Intonation Patterns.

Practical: Exercises in Word Classes. Study of Verb Patterns. Use of Tenses and Voice. Exercises in the Use of Conjunctions and Prepositions. Exercises in Sentence Patterns. Writing Reports on Topics relating to Horticulture/Forestry, using Active and Passive Sentences. (i) Conversations related to Everyday Situations, (ii) Selection and Practice of

Conversations for the Study of the Concept of Stress, Stress Shift, Silent Letters in Words and Basic Intonation Patterns.

XI. Physical Education 1(0+1)

XII. NCC/NSS 1(0+1)

XIII. Introductory Botany (NC) 3(2+1)

Introduction to Botany and general classification of plants. Parts of a typical flowering plant. Morphology of root, stem, leaf and flower. Structure and types of plant tissues. Internal structure of dicot and monocot stems, roots and a typical leaf. Significance of life cycle with special reference to alternation of generations in *Chlamydomonas*, *Rhizopus*, *Funaria*, *Adiantum*, *Pinus* and a flowering plant. Importance of plants in relation to environments.

Practical: Morphological studies of roots, stems, leaves and flowers. Studies of permanent slides of histology and anatomy. Morphological studies of gametophytes and sporophytes of the plants pertaining to the life cycle. General survey of the local vegetation. A field trip during the semester.

IVX. Basic Mathematics (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.

2.6. Forestry Work Experience

I. Socio-Economic Surveys (Village attachment - 11 days) 2(0+2)

Practical: Bench Mark Survey of Agroforestry related situations (cropping pattern, yield system etc.); Schedule development, tabulation, analysis and preparing plan of work. Data collection with respect to village profile-farmers/tribals socio-economic status gender issues and technology practices adopted. Understanding local forestry institutional and village level interventions (Panchayat, VFC's, Co-operatives, Corporations, Youth/Women Groups etc.). People's participation in developmental programmes with special reference to forestry. Preparation and use of extension methods and teaching aids for TOT.

II. Field Training 8(0+8) (Attachment with State Forest Department - 42 days)

Practical: Visit to modern forest nurseries, herbal gardens and watersheds. To study the medicinal and aromatic plants diversity, their conservation and domestication. Study the felling and logging operations, timber lots and industrially important products. Introduction to Working Plan, data generation-enumeration and volume/yield calculation. Writing of compartment history files. Study the catchment area treatment plant and FDA. Study the Regeneration and Management of regionally important forestry tree species. Laying out sample plots, stump analysis, preparation of local volume table and use of forestry field equipments/ Instruments. Visit to National Parks, Sanctuaries and Bio-sphere reserves. Visit to ecologically degraded areas around cement plants, mined areas etc. and study rehabilitation measures adopted.

III. Hands on Training (Institutional– 28 days) 4 (0+4)

Practical: Production of Quality Nursery Stock; Field Plantations; Processing & Packaging of non-wood forest products; Sericulture and Apiculture; Production of Biofertilizers and organic manure; Farming Systems – Agroforestry; Farm/Forest Management; Tractor driving and field Instruments training; Carpentry and Bamboo craft.

IV. Hands on Training 4 (0+4) (Forest Based Industries - 40 days)

Practical: Study the nature and structure of Industrial and Business Organization; Raw-material – Procurement and Processing; Production, Marketing and Economics at Wood workshop and saw mills/ Wood seasoning and preservation treatment units/ Pulp and Paper Industries/ Katha making industry/ Rosin and Turpentine Industry; Herbal Pharmacies/ Other wood Product Industries.

V. Report Writing & Presentation (3 days) 2 (0+2)

Practical: The students shall prepare a comprehensive report of all the training components and make an oral presentation.