

CENTRAL AGRICULTURAL UNIVERSITY

Academic Regulations

and

Course Syllabus

for

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



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 horticulture 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. (In addition, at present two seats are reserved for Nagland)

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. Horticulture 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 jest 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 HORTICULTURE (AS PER FORTH DEANS COMMITTEE ON AGRICULTURAL EDUCATION IN INDIA)

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

Fruit Science		
1.	Fundamentals of Horticulture	3(2+1)
2.	Plant Propagation and Nursery Management	2(1+1)
3.	Tropical and Subtropical Fruits	3(2+1)
4.	Temperate Fruits	2(1+1)
5.	Orchard Management	2(1+1)
6.	Plantation Crops	3(2+1)
7.	Weed Management in Horticultural Crops	2(1+1)
8.	Principles of Genetics and Cytogenetics	3(2+1)
9.	Principles of Plant Breeding	3(2+1)
10.	Breeding of Fruit and Plantation Crops	3(2+1)
	Total	16+ 10=26
Vegetable Crops		
1.	Tropical and Subtropical Vegetables	3(2+1)
2.	Spices and Condiments	3(2+1)
3.	Breeding of Vegetable Tuber and Spice Crops	3(2+1)
4.	Seed Production of Vegetable Tuber and Spice Crops	3(2+1)
5.	Temperate Vegetables	2(1+1)
6.	Potato and Tuber Crops	2(1+1)
	Total	16(10+6)
Post Harvest Technology		
1.	Post harvest Management of Horticultural Crops	3(2+1)
2.	Processing of Horticultural Crops	3(1+2)
3.	Fundamentals of Food Technology	2(1+1)
	Total	8(4+4)
Floriculture & Landscaping		
1.	Ornamental Horticulture	3(2+1)
2.	Breeding and Seed Production of Ornamental Crops	3(2+1)
3.	Principles of Landscape Gardening	1(0+1)
4.	Commercial Floriculture	3(2+1)
	Total	10(6+4)
Plant Protection		
1.	Fundamentals of Plant Pathology	3(2+1)
2.	Mushroom Culture	1(0+1)
3.	Diseases of Fruit, Plantation and Medicinal and Aromatic Crops	3(2+1)
4.	Diseases of Vegetable, Ornamental and Spice Crops	3(2+1)
5.	Fundamentals of Entomology	3(2+1)
6.	Nematode Pests of Horticultural Crops and their Management	2(1+1)
7.	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)
8.	Apiculture	1(0+1)
9.	Insect Pests of Vegetable, Ornamental and Spice Crops	3(2+1)
	Total	22(13+9)

Natural Resource Management		
1.	Fundamentals of Soil Science	2(1+1)
2.	Soil Fertility and Nutrient Management	2(1+1)
3.	Environmental Science	3(2+1)
4.	Soil and Plant Analysis	2(1+1)
5.	Farm Power and Machinery	2(1+1)
6.	Water Management in Horticultural Crops	2(1+1)
7.	Organic Farming	3(2+1)
	Total	16(9+7)
Basic Sciences		
1.	Elementary Statistics and Computer Application	3(2+1)
2.	Elementary Plant Biochemistry & Biotechnology	3(2+1)
3.	Introductory Crop Physiology	2(1+1)
4.	Introductory Economics	2(2+0)
5.	Horti-Business Management	2(2+0)
6.	Fundamentals of Extension Education	2(1+1)
7.	Entrepreneurship Development and Communication Skill	2(1+1)
8.	Growth and Development of Horticultural Crops	2(1+1)
9.	Structural grammar & Spoken English (NC)	2(1+1)
10.	Introductory Microbiology	2(1+1)
	Total	22(14+8)

Others		
1.	Introductory Agro-forestry	2(1+1)
2.	Medicinal and Aromatic Crops	3(2+1)
3.	Introduction to Major Field Crops	2(1+1)
4.	Physical Education (NC)	1(0+1)
	Total	8(4+4)
	Grand Total	128

Hands On Training/ Experiential Learning: Final year B.Sc. (Hort.) students to select any two areas of the following to undergo specialized training.

Protected cultivation of high value crops	Nursery production and management
Post harvest technology and value addition	Floriculture and landscape gardening

V

II and VIII Semester

Sr.	Activity	Credits	Weeks
1	Experiential learning (Professional Package)	5+10	14
2	Experiential learning (Professional Package)	5+10	14
3	RHWEP & Placement in industries	0+10	6
	Total	10+30	34

2. Syllabus

2.1 Fruit Science

I. 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.

II. Plant Propagation and Nursery Management 2(1+1)

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy (scarification & stratification) internal and external factors, nursery techniques, apomixes – mono-embryony, polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, nursery (tools and implements), use of growth regulators in seed and vegetative propagation, methods and techniques of cutting, layering, grafting and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers. Micrografting, hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

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

III. Tropical and Sub-Tropical Fruits 3(2+1)

Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, bael, banana, grapes, citrus, papaya, sapota, guava, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production. Rainfed horticulture, importance and scope of arid and semi-arid zones of India. Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

Practical: Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, de-suckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona.

IV. Temperate Fruits 2(1+1)

Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. Re- plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures.

Practical: Nursery management practices, description and identification of varieties of above crops, manuring and fertilization, planting systems, preparation and use of growth regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

V. Orchard Management 2(1+1)

Orchard management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil

management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Integrated nutrient and pest management. Utilization of resources constraints in existing systems. Crop model and crop regulation in relation to cropping systems.

Practical: Layout of different systems of orchard soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

VI. Plantation Crops 3(2+1)

History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea and rubber.

Practical: Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cacao. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.

VII. Weed Management in Horticultural Crops 2 (1+1)

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

Practical: Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problem areas.

VII. Principles of Genetics and Cytogenetics 3 (2+1)

Historical background of genetics, theories and hypothesis. Physical basis of heredity, cell reproduction, mitosis, meiosis and its significance. Gametogenesis and syngamy in plants. Mendelian genetics—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 linked inheritance and characters. Cytoplasmic inheritance and maternal effects. Chemical basis of heredity, structure of DNA and its replication. Evidence to prove DNA and RNA – as genetic material. Mutations and their classification. Chromosomal aberrations, changes in chromosome structure and number.

Practical: Study of fixatives and stains. Squash and smear techniques. Demonstrations of permanent slides and cell division, illustration in plant cells, pollen fertility and viability, determination of gametes, Solving problems of monohybrid, dihybrid, and test cross ratios using chi-square test, gene interactions, estimation of linkages using three point test cross from F2 data and construction of linkage maps. Genetics variation in man.

VIII. Principles of Plant Breeding 3 (2+1)

Plant breeding as a dynamic science, genetic basis of Plant Breeding – classical, quantitative and molecular, Plant Breeding in India – limitations, major achievements, goal setting for future. Sexual reproduction (cross and self pollination), asexual reproduction, pollination control mechanism (incompatibility and sterility and implications of reproductive systems on population structure). Genetic components of polygenic variation and breeding strategies, selection as a basis of crop breeding. Hybridization and selection – goals of hybridization, selection of plants; population developed by hybridization – simple crosses, bulk crosses and complex crosses. General and special breeding techniques. Heterosis – concepts, estimation and its genetic basis.

Practical: Breeding objectives and techniques in major field crop plants. Floral biology – its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques.

IX. Breeding of Fruit and Plantation Crops 3 (2+1)

Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement – policy manipulations – *in vitro* breeding tools (important fruit and plantation crops).

Practical: Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy.

2.1. Vegetable Crops

I. Tropical and Sub-Tropical Vegetables 3(2+1)

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate,

preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield and seed production. Economic of cultivation of tropical and sub-tropical vegetable crops; post-harvest handling and storage. Marketing of tomato, brinjal, chillies, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca and basella.

Practical: Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

II. Spices and Condiments 2(1+1)

History, scope and importance, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micro-propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, pepper, ginger, turmeric, clove, nutmeg, cinnamon, all spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

Practical: Identification of varieties: propagation, seed treatment – sowing; layout, planting; hoeing and earthing up; manuring and use of weedicides, training and pruning; fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

III. Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

Centres of origin, plant bio-diversity and its conservation. Models of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops. Self-incompatibility and male sterility, its classification and application in crop improvement. Principles of breeding self-pollinated crops, pure line selection, mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method and back cross method. Polyploidy breeding. Mutation breeding. Principles of breeding cross pollinated crops, mass selection, recurrent selection, heterosis breeding, synthetics and composites. Application of biotechnology in crop improvement. Crops: Solanaceous vegetables, cole crops, cucurbits, bulb crops, root crops, leafy vegetables, okra, leguminous crops.

Practical: Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

IV. Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

Introduction and history of seed industry in India. Definition of seed. Differences between grain and seed. Importance and scope of vegetable seed production in India. Principles of vegetable seed production. Role of temperature, humidity and light in vegetable seed production. Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation.

Practical: Study of seed structure, colour size, shape and texture. Field inspection of seed crops. Practices in rouging. Harvesting and seed extraction. Germination and purity analysis. Methods of seed production in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, leafy vegetables, leguminous vegetables and exotic vegetables. Seed processing machines. Visit to seed production units.

V. Temperate Vegetables 2(1+1)

Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, seed production, post-harvest technology. Marketing of cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke.

Practical: Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

VI. Potato and Tuber Crops 2(1+1)

Origin, area, production, economic importance and export potential of potato and tropical, sub-tropical and temperate tuber crops; description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems. Harvesting practices, yield; seed production, economic of cultivation. Post-harvest handling and storage, field and seed standards, marketing. Crops to be covered – potato, tapioca, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tuber crops.

Practical: Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Top dressing of fertilizers and interculture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, post-harvest handling and storage, marketing. Seed collection, working out cost of cultivation, project preparation of commercial cultivation.

2.3. Post-Harvest Technology

1. Post Harvest Management of Horticultural Crops 3 (2+1)

Importance of post-harvest technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants. Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce, physiological and bio-chemical changes, hardening and delaying

ripening process. Post-harvest treatments of horticultural crops. Quality parameters and specification. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Methods of storage for local market and export. Pre-harvest treatment and pre-cooling, pre-storage treatments. Different systems of storage, packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments. Modes of transport.

Practical: Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases in spices. Visit to markets, packaging houses and cold storage units.

II. Processing of Horticultural Crops 3 (1+2)

Importance and scope of fruit and vegetable preservation industry in India, food pipe line, losses in post-harvest operations, unit operations in food processing. Principles and guidelines for the location of processing units. Principles and methods of preservation by heat pasteurization, canning, bottling. Methods of preparation of juices, squashes, syrups, cordials and fermented beverages. Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves chemical preservatives, preservation with salt and vinegar, pickling, chutneys and sauces, tomato and mushrooms, freezing preservation. Processing of plantation crops, products, spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

Practical: Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables – tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Visit to processing units.

III. Fundamentals of Food Technology 2 (1+1)

Food and its function, physico-chemical properties of foods, food preparation techniques, nutrition, relation of nutrition of good health. Characteristics of well and malnourished population. Energy, definition, determination of energy requirements, food energy, total energy needs of the body. Carbohydrates: classification, properties, functions, source, requirements, digestion, absorption and utilization. Protein, classification, properties, functions, sources, requirements, digestion, absorption, essential and non-essential amino acids, quality of proteins, PER/NPR/NPU, supplementary value of proteins and deficiency. Lipids – classification, properties, functions, sources, requirements, digestion, absorption and utilization, saturated and unsaturated fatty acids, deficiency, rancidity, refining of fats. Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. Vitamins: functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins. Balanced diet: recommended dietary allowances for various age groups, assessment of nutritional status of the population.

Practical: Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.

2.4. Floriculture & Landscaping

I. Ornamental Horticulture 3 (2+1)

History, scope of gardening, aesthetic values. Gardens in India, types of gardens. Landscaping, historical background, definition. Floriculture industry: importance, area and production, industrial importance in India. Landscaping, basic principles and basic components. Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, climbers and creepers, palms, ferns, grasses and cacti succulents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds. Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens.

Practical: Identification and description of annuals, herbaceous, perennials, climbers, creepers, foliage flowering shrubs, trees, palms, ferns, ornamental grasses; cacti succulents. Planning and designing gardens, layout of location of components of garden study, functional uses of plants in the landscape. Planning design of house garden, roadside planting, avenues for new colonies, traffic islands, preparation of land for lawn and planting. Description and design of garden structures, layout of rockery, water garden, terrace garden, and Japanese gardens, recreational and children's corner. Layout of terrarium, traffic islands, bottle garden, dish garden. Flower arrangement, bonsai practicing and training. Visit to nearby gardens. Identification and description of species/varieties of jasmine, chrysanthemum, marigold, dahlia, gladiolus, carnation, aster and their important inter-culture practices

II. Breeding and Seed Production of Ornamental Crops 3(2+1)

History of improvements of ornamental plants, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental plants. Breeding for disease resistance. Development of promising cultivars of important ornamentals. Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed. Harvesting processing and storage of seeds, seed certification.

Practical: Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods

III. Principles of Landscape Gardening 1 (0+1)

Practical: Principles and elements of landscape design, plant material for landscaping, symbols, tools and implements used in landscape design, layout of formal gardens, informal gardens, special type of gardens (bog garden, sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Landscape design for specific areas.

IV. Commercial Floriculture 3(2+1)

Scope and importance of commercial floriculture in India, production techniques of ornamental plants like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market,

growing of flowers under protected environments such as glass house, plastic house etc., post harvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

Practical: Identification of commercially important floricultural crops. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting. Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices

2.5. **Plant Protection** (Sections: Plant Pathology, Entomology and Nematology)

I. **Fundamentals of Plant Pathology** 3 (2+1)

Introduction to the science of phytopathology, its objectives, scope and historical background. Classification of plant diseases, symptoms, signs, and related terminology. Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification. Non-parasitic causes of plant diseases. Infection process. Survival and dispersal of plant pathogens. Plant disease epidemiology, forecasting and disease assessment. Principles and methods of plant disease management. Integrated plant disease management.

Practical: Familiarity with general plant pathological laboratory and field equipments. Study of disease symptoms and signs and host parasite relationship. Identification and isolation of plant pathogens. Koch's postulates. Preparation of fungicidal solutions, slurries, pastes and their applications.

II. **Mushroom Culture** 1(0+1)

Introduction to mushrooms fungi – nutritional value, edible and poisonous types, edible mushrooms, *Pleurotus*, *Volvariella* and *Agaricus*, medicinal value of mushrooms, genetic improvement of mushroom, preparation of culture, mother spawn production, multiplication of spawn, cultivation techniques, harvesting, packing and storage; problems in cultivation – diseases, pest and nematodes – weed moulds and their management strategies. Economics of cultivation, post harvest technologies.

Equipment and sterilization techniques for culture media, isolation of mother culture, and spawn preparation and maintenance of mushroom beds of oyster mushroom, *Volvariella* and *Agaricus*. Processing and preservations of mushrooms, economics of spawn and mushroom production and mushroom recipes

III. **Diseases of Fruits, Plantation and Medicinal and Aromatic Crops** 3 (2+1)

Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and aromatic crops viz mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, plum, almond, walnut, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia. Important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.

Practical: Observations of disease symptoms, identification of casual organisms and host parasite relationship of important diseases. Examination of scrapings and cultures of important pathogens of fruits, plantation, medicinal and aromatic crops.

IV. Diseases of Vegetable, Ornamental and Spice Crops 3 (2+1)

Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical: Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops.

V. Fundamentals of Entomology 3 (2+1)

Introduction to phylum arthropoda. Importance of class Insecta. Insect dominance. Definition, division and scope of entomology. Comparative account of external morphonology-types of mouth parts, antennae, legs, wings and genetallia. Anatomy of digestive, excretory, nervous and reproductive systems. Postembryonic development-eclosion. Matamorphosis. Types of larvae and pupa. Classification of insects upto orders and families of economic importance and their distinguished characters.

Practical: Insect collection and preservation. Identification of important insects. General body organization of insects. Study on morphology of grasshopper. Preparation of permanent mounts of mouth parts, antennae, legs and wings. Dissection of grasshopper and caterpillar for study of internal morphology. Observations on metamorphosis of larvae and pupae.

VI. Nematode Pests of Horticultural Crops and their Management 2 (1+1)

History of development of nematology - definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy, classification, biology, symptomatology and control of important plant parasitic nematodes of fruits – (tropical, sub-tropical and temperate) vegetables, tuber, ornamental, spice and plantation crops. Role of nematodes in plant disease complex.

Practical: Methods of sampling and extraction of nematodes from soil and plant parts, killing, fixing and preparation of temporary and permanent nematode mounts. Nematicides and their use. Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.

VII. Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)

General – economic classification of insects; ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia.. Storage insects – distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits,

plantation, medicinal and aromatic crops and their processed products. Toxicology – insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their tolerance limits.

Practical: Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops in field and storage

VIII. Apiculture

1(0+1)

Practical: Importance and history of apiculture, different species of bees, morphology, anatomy, colony organization and life cycle, bee-keeping equipment, social behaviour, reproduction, queen rearing, bee pasturage, seasonal management, economics of bee-keeping. Bee enemies, diseases of bees, role of bees in increasing the productivity of horticultural crops in India economy, bee products and their uses. Recent trends in apiculture. Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee-keeping equipment, bee forage plants. Collection and preservation of bee flora, enemies and diseases of bees. Handling of bee colonies and manipulation for honey production.

IX. Insect Pests of Vegetable, Ornamental and Spice Crops

3 (2+1)

Economic importance of insects in vegetable, ornamental and spice crops -ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable, ornamental and spice crops. Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bio-ecology, injury and integrated management. Insect –pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.

Practical: Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

2.6. Natural Resource Management

I. Fundamentals of Soil Science

2(1+1)

Composition of earth's crust, soil as a natural body – major components. Eluviations and illuviation formation of various soils. Problem soils: salt soils, permeable, flooded, sandy soil 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 (bulk density), AD – practical problems. Pore space – definition, factors affecting capillary and non-capillary porosity, soil colour – definition, its significance, colour variable, value hue and 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. Ion exchange, cation-anion importance, soil organic matter decomposition, pH and 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 – classification – aerial photography – satellite of soil features – their interpretation; soil orders; land capability classification; soil of different eco-systems and their properties, management of problem soils– soils environmental quality. Irrigation water quality, determination of quality parameters, empirical equation management of irrigation water.

Practical: Collection and preparation of soil samples, estimation of moisture, EC, pH and bulk density. Textural analysis of soil by Robinson's pipette method, chemical analysis of soil – Fe₂O₃, P, K, Ca, Mg and S, total N, organic carbon and cation exchange capacity.

II. Soil Fertility and Nutrient Management 2 (1+1)

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils –characteristics and management. Role of microorganisms in organic matter- decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis.

Practical: Analysis of soil for organic matter, available N,P,K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils.

III. Environmental Science 3 (2+1)

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

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

IV. Soil and Plant Analysis 2 (1+1)

Methods of soil and plant sampling and processing for analysis. Quantification of minerals and their abundance. Soil structure and aggregate analysis. Theories and concepts of soil moisture estimation – gravimetric, tensiometric, gypsum block, neutron probe and pressure methods. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential. Soil fertility evaluation methods. Use of radio tracer techniques in soil fertility

evaluation. Soil micro-organisms and their importance. Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis values. Principles of working of pH meter, electrical conductivity meter, spectrophotometer, flame photometer and atomic absorption spectrophotometer. Quality of irrigation water.

Practical: Collection and preparation of soil and plant samples for analysis. Determination of water holding capacity and hydraulic conductivity of soil. Estimation of moisture content in soils and plants. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils. Enumeration of soil microbes. Estimation of available macro and micronutrient elements in soils and their contents in plants. Irrigation water quality analysis.

V. Farm Power and Machinery 2 (1+1)

Basic concepts of various forms of energy, unit and dimensions of force, energy and power, calculations with realistic examples. IC Engines: Basic principles of operation of compression, ignition and spark ignition engines, two stroke and four stroke engines, cooling and lubrication system, power transmission system, broad understanding of performance and efficiency, tractors, power tillers and their types and uses. Electric motors: types, construction and performance comparison. Tillage: objectives, method of ploughing. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs. Secondary tillage implements: construction and function of tillers, harrows, levelers, ridgers and bund formers. Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter. Grafting, pruning and training tools and equipment. Inter-culture equipment: sweep. Junior hoe, weeders, long handle weeders. Crop harvesting equipments: potato diggers, fruit pluckers, tapioca puller and hoists.

Practical: Calculation on force, power and energy. IC engines – showing the components of dismantled engines and motors. Primary and secondary tillage implements, hitching, adjustments and operations. Spraying equipment, calibration and operation. Plant protection equipment, calculation of dilution ratio and operation.

V. Water Management in Horticultural Crops 2(1+1)

Importance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth. Available and unavailable soil moisture – distribution of soil moisture – water budgeting – rooting characteristics – moisture extraction pattern. Water requirement of horticultural crops – lysimeter studies – Plant water potential climatological approach – use of pan evaporimeter – factor for crop growth stages – critical stages of crop growth for irrigation. Irrigation scheduling – different approaches – methods of irrigation – surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler. Layout of underground pipeline system.

Practical: Measurements of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants and soil moisture by using different, methods and instruments, scheduling of irrigation, different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices.

VII. 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.

2.7. Basic Sciences

1. 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, poison 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, quadrille, 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.

II. Elementary Plant Biochemistry and Biotechnology

3(2+1)

Carbohydrates: Occurrence classification and structure, physical and chemical properties of carbohydrates, isomerism, optical activity, reducing property, reaction with acids and alkalis, ozone formation. Lipids: Classification, important fatty acids and triglycerides, essential fatty acids. Physical and chemical control of oils, their rancidity, phospholipids, types and

importance. Plant pigments – structure and function of chlorophyll and carotenoids, sterols, basic structure, role of brassinosterols in plants. Proteins: Classification, function 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 reaction of proteins. Enzymes: Classification and mechanism of action; factors affecting enzyme action, co-factors and co-enzymes. Vitamins and minerals as co-enzymes/co-factors. Carbohydrate metabolism – glycolysis and TCA-cycle; metabolism of lipids, fatty acid oxidation, biosynthesis of fatty acids, electron transport chain, bioenergetics of glucose and fatty acids, structure and function of nucleic acid replication, transcription and translation. History of biotechnology. Fundamental principles, micro-propagation and scope for commercialization. Application of micro-grafting in horticultural crops, meristem culture, anther culture, pollen culture, embryo culture, callus culture, cell culture, somoclonal variation, protoplast isolation, culture, fusion and applications. Cryopreservation .Genetic engineering. Future scope and present trends. Importance of biotechnology in horticulture

Practical: Preparation of standard solutions and reagents. Carbohydrates – qualitative reaction, estimation of starch, reducing and non-reducing sugars; reaction of proteins, estimation of proteins by Lowery method. Estimation of free fatty acids; determination of iodine number of vegetable oils. Vitamins – estimation of ascorbic acid. Paper and thin layer chromatography. Sterilization techniques – composition and preparation of media – micro-propagation of tomato. Callus culture, sub-culturing, induction of rooting-techniques in hardening

III. Introductory Crop Physiology

2(1+1)

Water Relations in Plants: Role of water in plant metabolism, osmosis inhibition, diffusion, water potential and its components, measurement of water potential in plants, absorption of water, mechanism of absorption and ascent of sap. Stomata: Structure, distribution, classification, mechanism of opening and closing of stomata. Osmotic pressure, guttation, stem bleeding; transpiration methods and mechanism and factors affecting transpiration. Drought: Different types of stresses; water, heat and cold tolerance; mechanism of tolerance. Plant Nutrition: Essentiality, mechanism of absorption and its role in plant metabolism. Photosynthesis, structure and function of chloroplast, dark and light reactions, cyclic and non-cyclic electron transfer, CO₂ fixation – C₃, C₄ and CA metabolism, advantages of C₄ pathway. Photorespiration and its implications, factors affecting photosynthesis. Phytohormones, physiological role in controlling plant processes. Environmental stimuli for plant development.

Practical: Measurement of water potential, osmosis, root pressure, structure of the stomata, distribution, opening and closing of the stomata, measurement, transpiration and calculation of transpirational pull demonstration. Importance of light and chlorophyll in photosynthesis, pigment identification in horticultural crops and studying the enzyme activity of catalase, estimation of phenols, studying plant movements, root initiation in cuttings.

IV. Introductory Economics

2(2+0)

Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification, utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi-marginal utility, indifference curve and its properties, consumer equilibrium. Theory of demand, demand schedule and curve, market demand. Price, income and cross elasticities, Engil’s law of family expenditure – consumer’s surplus. Theory of firm, factors of production – land and its characteristics, labour and division of labour, theories of

population. Capital and its characteristics – classification and capital formation. Enterprises – forms of business organization – merits and demerits. Laws of return – law of diminishing marginal return – cost concepts. Law of supply – supply schedule and curve elasticities. Market equilibrium, distribution – theories of rent, wage, interest and profit. Price determination and forecasting under various market structures.

V. Horti- Business Management 2 (2+0)

Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – factors, product, relationship – factors relationship, product relationship, optimum conditions, principles of opportunity cost-equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty. Farming systems and types. Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans. Organizations – forms of business organizations, organizational principles, division of labour. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability. Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling – evaluation, control systems and devices. Budgeting as a tool for planning and control. Record keeping as a tool of control. Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality. Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ). Personnel management – recruitment, selection and training, job specialization. Marketing management – definitions, planning the marketing programmes, marketing mix and four P's. Financial management – financial statements and ratios, capital budgeting. Project management – project preparation evaluation measures.

VI. 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 Deptt. 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.

VII. 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 horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of horti inputs industry. Characteristics of Indian horticultural 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, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

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

VIII. Growth and Development of Horticultural Crops 2(1+1)

Growth and development-definitions, components, photosynthetic productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, growth analysis in horticultural crops. Plant bioregulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits.

Practical: Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, rapid tissue test, seed dormancy, seed viability by tetrazolium test, seed germination and breaking seed dormancy with chemicals and growth regulators.

IX. Structural Grammar and Spoken English (NC) 2 (1+1)

Structural Grammar: Introduction of Word Classes; Structure of Verb in English; Uses of Tenses; Study of Voice; Study 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; silent letters in words and pronunciation of words with silent letters, the basic intonation patterns.

Practical: Structural Grammar: Exercises in word classes, identification and study of verbs in sentences, application of tenses and voice, exercises in conjunctions and prepositions, other structural grammar exercises, report writing, letter writing (different types of letters). Spoken English: Conversations of everyday life, the concept of stress; stress shift. Silent letters in words, basic intonation patterns, preparing and address.

X. Introductory Microbiology 2(1+ 1)

History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Microscopy and Specimen Preparation: The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eucaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture techniques. Microbial growth in models of bacterial, yeast and mycelial growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. General principle of bacterial genetics, DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association.

Practical: Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plats, turbidometric estimation of microbial growth

2.8. Others

I. Introductory Agroforestry 2 (1+1)

Agroforestry – definition, objectives and potential. Distinction between agroforestry and social forestry. Status of Indian forests and role in India farming systems. Agroforestry system, sub-system and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks, shelterbelts and energy plantations. Planning for agroforestry – constraints, diagnosis and design methodology, selection of tree crop species for agro-forestry. Agroforestry projects – national, overseas, MPTS – their management practices, economics of cultivation – nursery and planting (*Acacia catechu*, *Dalbergia sissoo*, *Tectona*, *Populus*, *Morus*, *Grewia*, *Eucalyptus*, *Quercus* spp. and bamboo, tamarind, neem etc.)

Practical: Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, *Grewia optima*, *Morus alba*, *Acacia catechu*, *Dalbergia sissoo*, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

II. Medicinal and Aromatic Crops 3 (2+1)

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural

practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of under mentioned important medicinal and aromatic plants. Study of chemical composition of a few important medicinal and aromatic plants, extraction, use and economics of drugs and essential oils in medicinal and aromatic plants. Therapeutic and pharmaceutical uses of important species. Medicinal Plants: Betelvine, periwinkle, Rauwolfia, Dioscorea, Isabgol, Ammi majus, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag (baje), lavender, geranium, patchouli, bursera, enthe, musk, Ocimum and other species relevant to the local conditions.

Practical: Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction essential oils.

III. Introduction to Major Field Crops 2 (1+1)

Classification and distribution of field crops, definitions and concept of multiple cropping, mixed cropping, intercropping, relay and alley cropping, cultural practices for raising major cereals, pulses, oil seeds and fodder crops, green masuering, crop rotation.

Practical: Identification of crop plants, seeds and weeds. Preparation of cropping scheme. Application of herbicides in field crops

IV. NSS/NCC / Physical Education (NC) 1(0+1)

NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: Introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training – rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games – football, hockey, cricket, volleyball, ball badminton, throw ball, tennikoit. Participation in one of the indoor games – shuttle badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events – broad jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-to-day activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience.

Note: Warming up and conditioning exercises are compulsory before the commencement of each class.

V. Horticultural Work Experience

20 (0+20)

The students will spend one full semester working with State Department of Horticulture; Horticulture based industries, commercial horticulture farms, plantation industries etc. to gain first hand information and hands-on-training in the chosen area of interest.