ANNAMALAI UNIVERSITY

ANNAMALAI NAGAR 608 002.

M.SC., (HORTICULTURE) IN FLORICULTURE AND LANDSCAPING

SYLLABUS

HAND BOOK

2022-2023

FACULTY OF AGRICULTURE
COMMON REGULATIONS FOR ALL
M.Sc. (AGRICULTURE/HORTICULTURE) AND MBA (AGRI. BUSINESS MANAGEMENT)
PROGRAMMES OFFERED BY
THE FACULTY OF AGRICULTURE
WITH EFFECT FROM 2022-2023

1. Short title and commencement

- These rules and regulations shall govern the post graduate studies leading to the award of degree of Master of Science (Agriculture/Horticulture) and MBA (Agri. Business Management) in the Faculty of Agriculture.
- They shall come into force with effect from the academic year 2022 – 2023.

Academic Year and Registration

- An academic year shall be normally from July to June of the following calendar year otherwise required under special situations. It shall be divided into two academic terms known as semesters. The Academic Calendar will be developed by the University from time to time and notified accordingly by the Registrar in advance.
- An orientation programme shall be organized by the Dean, Faculty of Agriculture for the benefit of the newly admitted students immediately after commencement of the semester.
- On successful completion of a semester, the continuing students shall register for subsequent semester on the date specified in the Academic/ Semester Calendar or specifically notified separately. Every enrolled student shall be required to register at the beginning of each semester till the completion of his/ her degree programmes

Registration Cards

- A student shall register the courses offered in a semester by writing all the courses in registration card in quadruplicate.
- The Chairman, PG coordinator and Head of the Department are responsible to furnish the registration particulars of the students with their signature in the Registration card to the Dean.
- The Dean shall approve the registration cards.
- The approved registration cards shall be maintained by the Head of the Department, Chairman and the student concerned.
- The list of courses registered by the students in each semester shall be sent by the Dean to the Controller of Examinations/University for preparation of Report Cards

2. Definitions

- "Semester" means an academic term consisting of 110 working days including final theory examinations.
- "Subject" means a unit of instruction to be covered in a semester having specific No., title and credits.

- "Credit hour" means, one hour lecture plus two hours of library or homework or two and half hours of laboratory/field practical per week in a semester.
- "Grade Point of a subject" means the value obtained by dividing the percentage of marks earned in a subject by 10 and the Grade Point is expressed on a 10 point scale.
- "Credit Point" means the grade point multiplied by credit hours.
- "Grade Point Average" (GPA) means the quotient of the total credit points obtained by a student in various subjects at the end of each semester, divided by the total credit hours taken by the student in that semester. The grading is done on a 10-point scale and the GPA has to be corrected to two decimals.

"Overall Grade Point Average" (OGPA) means the quotient of cumulative credit points obtained by a student in all the subjects taken from the beginning of the first semester of the year divided by the total credit hours of all the subjects which he/she had completed up to the end of a specified semester and determines the overall performance of a student in all subjects during the period covering more than one semester. The OGPA has to be arrived at the second decimal place.

3. Courses offered

The details of various post-graduate degree programmes at Masters' level offered in the Faculty of Agriculture are as follows:

- Agronomy
- Entomology
- Agricultural Microbiology
- Genetics and Plant Breeding
- Seed Science and Technology
- Plant Molecular biology and Biotechnology
- Horticulture -
  - Fruit Science
  - Vegetable Science
  - Floriculture and Landscaping
  - Plantation, Spices, Medicinal and Aromatic Crops
- Plant Pathology
- Soil Science and Agricultural Chemistry
- Agricultural Extension
- Agricultural Economics
- M.B.A (Agri. Business Management)

4. Eligibility for admission

Candidates for admission to the M.Sc. (Ag. /Hort.) programme should satisfy the following requirements.

4.1. Candidates seeking admission to the M.Sc. (Ag. /Hort.) Degree programme should have completed any one of the following four-year degree programmes from

Faculty of Agriculture, Annamalai university or Universities/colleges accredited with ICAR, New Delhi.

- **For M.Sc. (Ag.) Agronomy**
  Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Ag.) courses of four years duration.
- **For M.Sc. (Ag.) Entomology, Genetics and Plant Breeding, Plant Pathology, Soil Science and Agricultural Chemistry, Seed Science and Technology, Plant Molecular biology and Biotechnology, Agricultural Microbiology, Agricultural Extension, Agricultural Economics and M.B.A (Agri. Business Management)**
  Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Hons.) Horticulture/B.Sc. (Ag.)/B.Sc. (Hort.) of four years duration.
- **For M.Sc. (Hort.)**
  Eligibility: B.Sc. (Hons.) Agriculture / B.Sc. (Hons.) Horticulture/ B.Sc. (Hort.) and B.Sc. (Ag.) courses of four years duration.

4.2. Candidates who have undergone the programme under conventional system should possess not less than a second-class Bachelor's degree. The candidates under 4-point grade systems should possess a minimum OGPA of 2.5 out of 4.00 and 2.75 out of 4.00 in the subject concerned. For those under 10-point system a minimum OGPA of 6.50 out of 10.00 and 7.00 out of 10.00 in the subject concerned is required. However, for SC/ST candidates OGPA of 6.75 out of 10.00 in the subject concerned is sufficient.

4.3. An entrance test will be held separately for each Degree programme. Selection of candidates shall be based on OGPA, Subject OGPA, Entrance Test and Interview

4.4. A student can apply to a maximum of two subjects only

5.1. Residential requirements

The duration for the M.Sc. (Agriculture/Horticulture) and MBA programme will be of two years with four semesters. A student registered for M.Sc. (Agriculture /Horticulture) programme should complete the course within five Academic year from the date of his/her admission.

In case a student fails to complete the degree programme within the maximum duration of residential requirement, his/ her admission shall stand cancelled. The requirement shall be treated as satisfactory in the cases in which a student submits his/ her thesis any time during the 4th semester of his/ her resident ship at the University.

5.2 Credit Grade Point Requirements

A student enrolled for the Master's degree programme to earn eligibility for the degree is required to complete 70 credits as detailed below.

I) Course work

Major Courses	20
Minor Courses	08
Supporting Courses	06
Common Courses	0**5**
Seminar	01
ii) Thesis Research	30
Total credits	**70**

Major courses: From the Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken will be given *mark

Minor courses: From the courses closely related to a student's major subject chosen by the students in consultation with the Head of the department and the Chairman based on their research specialization.

Supporting courses: The subjects not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments, etc.) or necessary for building his/ her overall competence.

a. List of supporting courses for M.Sc. (Ag.) Agronomy, Agricultural Entomology, Genetics and Plant Breeding, Plant Pathology, Soil Science and Agricultural Chemistry, Seed Science and Technology, Plant Molecular biology and Biotechnology, Agricultural Microbiology and Horticulture are

STA 501	Statistical Methods for Applied Sciences	3 (2+1)
COM 501	Information Technology in Agriculture	3 (2+1)

b. List of supporting courses for M.Sc. (Ag.) Agricultural Extension, Agricultural Economics and M.B.A (Agri. Business Management)

STA 502	Statistical Methods for social Sciences	3 (2+1)
COM 501	Information Technology in Agriculture	3 (2+1)

Common Courses: The following courses (one credit each) will be offered to all students undergoing Master's degree programme:

1. PGS 501 - Agricultural Research, Research Ethics and Rural Development Programmes (1+0)
2. PGS 502 - Technical Writing and Communications Skills (1+0)
3. PGS 503 - Basic Concepts in Laboratory Techniques (0+1)
4. PGS 504 - Library and Information Services (1+0)
5. PGS 505 - Intellectual Property and its management in Agriculture (1+0)

Some of these courses are already in the form of e-courses/ MOOCs. The students may be allowed to register these courses/ similar courses on these aspects, if available online on SWAYAM or any other platform. If a student has already completed any of these courses during UG, he/ she may be permitted to register for other related courses with the prior approval of the Head of Department (HoD)/ Board of Studies (BoS).

5.4. Minimum Grade point requirement

A post graduate student should maintain a minimum Grade Point of 6.50 out of 10 to secure a pass in a subject. In the subjects in which a student fails, he/she has to reappear for the examination to get a pass in that subject.

6. Attendance requirement

6.1. One hundred per cent attendance is expected of each student. A student, who fails to secure a minimum of **80 per cent** of attendance in each subject separately for theory

and practical, shall not be permitted to appear for the final examination in that subject and will be required to repeat the subject when ever offered.

In case of new admission, who are permitted to join late due to administrative reasons, the attendance will be calculated from the date of joining of the student. However, for genuine reasons, condonation of attendance deficiency may be considered by the Vice-Chancellor on the recommendation of the Head of the Department and the Dean, Faculty of Agriculture on payment of condonation fee prescribed by the University.

6.2 Students absenting from the classes with prior permission of the Head of the Department/Dean, Faculty of Agriculture on official University business shall be given due consideration in computing attendance.

7. Advisory Committee

7.1. Each post-graduate student shall have an Advisory Committee to guide him/her in carrying out the research programme. The Advisory Committee shall comprise a Major Advisor (Chairman) and two members. Of the two members, one will be from the same Department and the other in the related field from the other Departments of Faculty of Agriculture. The Advisory Committee shall be constituted within three weeks from the date of commencement of the first semester.

7.2 For interdisciplinary research requiring expertise from teaching staff of other faculties, due permission need to be obtained from the Dean, Faculty of Agriculture to nominate them as technical advisors. An official letter in this regard needs to be communicated to the individual concerned. However, they are restrained from the evaluation of Research/Seminar evaluation.

7.3. **Major Advisor (Chairman)**

Every student shall have a Major Advisor who will be from his/her major field of studies. The appointment of Major Advisor (Chairman) shall be made by the Head of the Department concerned. The chairman in consultation with the Head of the Department will nominate the other two members. In the event of the Major Advisor being away on other duty/leave for a period of more than three months, the member of the Advisory Committee from the same Department will officiate as the Major Advisor.

Advisor/ Co-guide/ Member, Advisory Committee from other collaborating University/ Institute/ Organization

• In order to promote quality post-graduate research and training in cutting edge areas, the University will enter into Memorandum of Understanding (MOU) with other Universities/ Institutions for conducting research. While constituting an Advisory Committee of a student, if the Chairperson, Advisory Committee feels the requirement of involving of a faculty member/ scientist of such partnering university/ Institute/ Organization, he/ she may send a proposal to this effect to the Dean, Faculty of Agriculture along with the proposal for consideration of Student's Advisory Committee.

• The proposed faculty member from the partnering institution can be allowed to act as Chairperson/ Co-guide/ Member, SAC, by mutual consent, primarily on the basis of

intellectual input and time devoted for carrying out the research work at the particular institution.

Allotment of students to the retiring persons

Normally, retiring faculty may not be allotted with M. Sc. Student if he/ she is left with less than 2 years of service.

Changes in the Advisory Committee:

i. Change of the Chairperson or any member of the Advisory Committee is not ordinarily permissible. However, in exceptional cases, the change may be effected with due approval of the Dean, faculty of Agriculture.

ii. Normally, staff members of the university on extra ordinary leave or on study leave or who leave the University service will cease to continue to serve as advisors of the post-graduate students of the University. However, the Dean, faculty of Agriculture may permit them to continue to serve as advisor subject to the following conditions:
    a) The concerned staff member must be resident in India and if he/ she agrees to guide research and must be available for occasional consultations;
    b) An application is made by the student concerned duly supported by the Advisory Committee;
    c) The Head of the Department and the Dean, Faculty of Agriculture agree to the proposal;

iii. In case the Chairperson/ member of Advisory Committee retires, he/ she shall be allowed to continue provided that the student has completed his course work and minimum of 10 research credits and the retiring Chairperson/ member stays at the Headquarters of the College, till the thesis is submitted.

iv. The change shall be communicated to all concerned by the Head of Department.

7.4. **Guidelines on the duties of the Advisory Committee**

- Guiding students in drawing the outline of research work
- Guidance throughout the programme of study of the students.
- Evaluation of research and seminar credits.
- Correction and finalization of thesis draft.
- Conduct of final Viva-Voce examination.
- The proceedings of the Advisory Committee will be sent to the Head of the Department concerned within 10 working days.
- Periodical review of the Advisory Committee proceedings will be made by the Head of the Department concerned.

8. Programme of Study

8.1 The student's plan for the post-graduate work, drawn up by the Advisory Committee, shall be finalized before the end of the first semester.

8.2 The programme shall be planned by the Advisory Committee taking into account his/her previous academic training and interest.

8.3 Programme of research work

The outline of research work of the student, in the prescribed manner and as approved by the Advisory Committee, shall be forwarded by the Chairman to the Head of the Department concerned by the end of the first semester.

9. EVALUATION OF STUDENTS' PERFORMANCE

Multiple levels of evaluation (First Test, Midterm and Final semester) will be conducted

9.1 First Test (FT) and Mid-semester examination (MSE)

9.1.1 Every teacher handling a subject shall conduct first Test (FT) as per the scheme drawn by the Head of the Department concerned /PG coordinator on the fourth week from the date of registration of the course, and evaluate. The evaluation process will be based on objective type questions and short concepts.

9.1.2 Every teacher handling a subject shall conduct Mid-Semester Examination (MSE) as per the scheme drawn by the Head of the Department concerned /PG coordinator, on the sixth week from the date of registration of the course and evaluate. The evaluation process will be of descriptive type.

9.1.3 The answer scripts of both FT and MSE will be shown to the student after valuation, and returned to the course teacher. The Head of the Department will be responsible to ensure the distribution of answer papers to the students. The marks obtained by the students should be sent to the Controller of Examinations through the Head of the Department concerned within fifteen working days.

9.1.4. Writing the first test and mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for FT/MSE, he/she is not eligible to appear for the final examinations. Such candidate has to reappear for the FT/MSE as and when the respective examinations are conducted only after getting permission from the Head of the Department concerned.

9.1.5 The FT and MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. FT and MSE marks awarded in a course will be added to the supplementary examinations also.

9.1.6 The FT and MSE marks will be furnished to the Head of the Department within 10 days after the conduct of Ft and MSE. If the student is not satisfied with the award of the marks, he/she shall appeal to the Dean, through Head of the Department within three working days after the announcement of marks. The appeal will be considered and the results reviewed by a Cell consisting of the Dean and the Head of the Department concerned. The decision of the Review Cell shall be final. If the Head of the Department himself is the course teacher, one senior member of the department concerned shall be nominated by the Dean.

9.1.7 The first test will be of 30 minutes duration and MSE of theory will be of one hour duration.

9.1.8 If the student is not able to write the FT/ MSE due to deputation by the University, he/she may be permitted to take up missing FT/MSE. Such examination should be completed ordinarily within 15 working days after the respective Ft/MSE.

9.1.9 A student who fails to attend a first test and mid-semester examination due to unavoidable circumstances shall be permitted with prior approval of the head of the Department to take up missing examination of the particular course. Such tests should be completed ordinarily within 15 working days after the respective FT/MSE.

The distribution of marks will be as indicated below.

Test	Subjects with Practical	Subjects without Practical	Subjects without Theory
First test	10	20	20
Mid-Semester	20	30	30
Final theory	30	50	-
Final practical	40	-	50
Total	**100**	**100**	**100**

The question paper model and distribution of marks for Mid Semester examinations is as follows.

First Test (30 minutes duration) (Total Marks: 10)

1. Objective Type	10 out of 12	10 x 0.5 marks	5 Marks
2.Definitions/ Short Concepts	5 out of 7	5 x 1 marks	5 Marks

Mid-semester examination

For Subjects with practicals(One hour duration) (Total marks: 20)

1. Objective Type	10 out of 12	10 x 0.5 marks	5 Marks
2.Definitions/ Concepts	5 out of 7	5 x 1 marks	5 Marks
3. Short Notes	2 out of 3	2 x 2 ½ marks	5 Marks
4. Essay Type	1 out of 2	1 x 5 marks	5 Marks

For Subjects without practicals(One hour duration) (Total marks: 30)

1. Objective Type	10 out of 12	10 x 0.5	5 Marks
2.Definitions/Concepts	5 out of 7	5 x 1	5 Marks
3. Short Notes	4 out of 5	4 x 2 ½	10 Marks
4. Essay Type	2 out of 3	2 x 5	10 Marks

9.2. Final examinations

9.2.1. The final theory and practical examinations will be of two and a half hours duration each conducted separately by the University.

9.2.2. The final theory and practical examinations will be evaluated by respective course teacher)

9.2.3. The question papers for the final theory examinations will be set by the external examiners.

The question paper model and distribution of marks for final theory examinations are as follows.

Final theory examination

For subjects with practical (2½ hour duration) (Total marks: 30)

1. Definitions	5 out of 7	5 x 1 marks	5 marks
2. Short Notes	2 out of 3	2 x 2½ marks	5 marks
3. Essay Type	Either or type (One question from each unit)	5 x 4 marks	20 marks

For subjects without practicals (2½ hour duration) (Total marks: 50)

1. Definitions	6 out of 8	6 x 1 marks	6 marks
2. Short Notes	3 out of 5	3 x 3 marks	9 marks
3. Essay Type	Either or type (One question from each unit)	5 x 7 marks	35 marks

9.2.4. Practical Examination

Practical examinations will be conducted in the last practical class. Proper maintenance and regular submission of practical records are required. Those who do not bring with them the certified practical records/ specimen collection/ assignments will not be allowed to appear for the practical examination. The marks awarded for specimen collection and assignments shall be noted in the record, at the time of first appearance and will be taken into account for subsequent appearances.

9.2.5. Assignment

Each student will be assigned a topic by the concerned course teacher. Such topic should cover a wide range of topics within the subject limits. The topic should be different from that of the credit seminar. Assignments will be evaluated during practical examination.

The distribution of marks for final practical examination for courses with theory and practical and only practical is as follows:

S. No.	Particulars	Courses with theory and practical	Courses only with practical
1	Practical part	25	55
2	Assignment/specimen collection	5	5
3	Record	5	5
4	Viva voce	5	5
	Total	**40**	**70**

The pattern of practical part should be uniform in each Department

9.3. GRADING

- The student should secure 60 per cent marks separately in theory and practical and 65 per cent marks in aggregate to secure a pass in the subject. Students who secure marks below 65 per cent in a subject will be treated as Reappearance (RA).
- Each subject shall carry a maximum of 100 marks for purpose of grading. The grading shall be done as grade point, i.e., the percentage of marks earned in a subject is divided by ten. The grade point is expressed on a 10-point scale up to two decimals.
- The reappearance examinations for the candidates who fail in a subject or subjects will be held in the subsequent semester.
- Students who did not fulfill the required minimum attendance of **80 per cent** will be awarded 'E' grade and has to repeat the subject.

9.4. Class / Percentage ranking

In calculation of percentage and class equivalent for OGPA the following classification shall be adopted.

OGPA	Percentage	**Class**
9.00 and above	90 and above	Distinction
8.00 to 8.99	80.00 to 89.99	I Class
7.00 to 7.99	70.00 to 79.99	II Class
6.50 to 6.99	65.00 to 69.99	Pass

10. Credit Seminar

Seminar is compulsory for all the students and each student should present a seminar of 0+1 credit in the third semester.

10.1 The seminar topic should be only from the major field and should not be related to the area of thesis research.

The seminar topics are to be assigned to the students by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned within 2 weeks after the commencement of the semester.

10.2. Under the guidance and supervision of the Chairman of the Advisory Committee, the student will prepare the seminar paper after reviewing all the available literature and present the seminar 2 weeks after completion of Mid-Semester Examination in the presence of the Head of the Department, Advisory Committee, staff members and PG students.

10.3. The circular on the seminars by the post-graduate students shall be sent to other Departments to enable those interested to attend the same.

10.4. The Chairman will monitor the progress of the preparation of the seminar paper and correct the manuscript containing not less than 25 typed/printed pages with a minimum number of 50 references covering the recent 10 years time. The student

will submit 2 copies of the corrected manuscript to the Head of the Department concerned through the Chairman before presentation.

The student will incorporate suggestions and carry out corrections made during the presentation and resubmit three fair copies to the Head of the Department concerned through the Chairman (one copy each to Dept. Library, Chairman and the student) within 10 days after presentation.

10.5 The performance of the student has to be evaluated for 100 marks and Grade Point will be awarded by Advisory Committee. The Grade Point may be given based on the following norms.

Coverage of Literature	40
Presentation	30
Use of Audio–Visual Aids	10
Capacity to Participate in the discussion and answer the Questions	20
Total	**100**

11. Absence of advisory committee member during final viva-voce examination:

11.1 Conducting final viva voce examination in the absence of advisory committee members is not allowed.

11.2. Under extra-ordinary circumstances if the final viva-voce examination to postgraduate student has to be conducted in the absence of one or two advisory committee members, permission to conduct the examination by co-opting another member in such contingencies should be obtained from the Dean in advance through the Head of the Department. The Chairman of the advisory committee in consultation with the concerned member and Head of the Department will co-opt another member.

11.3. The co-opted member should be from the same department of the member who is not attending the examinations.

11.4. In the absence of the Chairman of advisory committee, respective Heads of Departments should act as Co-chairman with prior permission of Dean.

12. Research Work

12.1. The topic of thesis research to be carried out by the student will be assigned by the Chairman of the Advisory Committee in consultation with the Head of the Department concerned. After assigning the topic, each student may be instructed to submit a detailed programme of work to be carried out by him/her during the semester in the prescribed proforma. After scrutiny and approval, a copy of the programme may be given to the student for carrying out the work during the semester in the prescribed proforma. The evaluation of research work done by the student should be based on the approved programme.

12.2. The distribution of research credits will be as follows:

I Semester	0+ 2
II Semester	0+ 6
III Semester	0+ 10
IV Semester	0+ 12*
Total	**0 + 30**

*** In the fourth semester out of 12 credits, 8 credits will be for evaluation of research and remaining 4 credits for evaluation of viva voce.**

13. Evaluation of Thesis Research

13.1. Attendance register must be maintained in the department by HOD /chairman for all the students to monitor whether the student has 80% of attendance in research.

13.2. The student has to submit his/her research observation note book to the major Advisor. The major Advisor will scrutinize the progress and sign the note book with remarks as frequently as possible. This note book will form the basis for evaluation of research progress.

13.3. After completion of 80% attendance for research and on or before the last day of the semester, the advisory committee should evaluate the progress of research work as per the approved programme and monitoring register and award **SATISFACTORY OR UNSATISFACTORY** depending upon quantity and quality of work done by the student during the semester.

13.4. The procedure of evaluating research credits under different situations are explained hereunder.

Situation - I

The students have completed the research credits as per the approved program and awarded **'SATISFACTORY'** by the advisory committee. Under the said situation the student can be permitted to register fresh credits in the subsequent semester. If the student is awarded **'UNSATISFACTORY'** he/she has to register afresh the same block of the research credits in the subsequent semester.

Situation - II

The student who does not satisfy the required **80 per cent** attendance shall be awarded grade 'E'.

Situation-III

The student who could not complete the research work as per the approved programme of work for reasons beyond his/her control such as

- Failure of crop
- Non-Incidence of pests or diseases or lack of such experimental conditions
- Non-availability of treatment materials like planting materials chemicals etc.
- Any other impeding/unfavourable situation for satisfying the advisory committee
- Under the situations (II&III) grade 'E' should be awarded. The student has to re-register the same block of research credits for which 'E' grade was awarded in the

following semester. The student should not be allowed to register for fresh (first time) research credits.

- In the mark sheet, it should be mentioned that 'E' grade was awarded due to lack of attendance or want for favourable conditions.

Situation – IV

The student who fails to complete the research work after repeating the registration for the second time will be awarded 'Unsatisfactory'.

- For the registration of research credits for the third time permission has to be obtained from the Dean of the Faculty and permission for further registration for the fourth time has to be obtained from the University.
- Re-registration of further research credits shall be decided by the University based on the recommendation of the Advisory Committee, Head of the Department concerned and the Dean, Faculty of Agriculture.

Situation -V

- If a student could not complete qualifying examination till the end of the final semester/grace period, 'E' grade should be awarded for the final block of the research credits registered in the final semester. He/She has to re-register the same block of research credits in the next semester and attend the qualifying examination when conducted by the Controller of Examinations.

14. Submission of Thesis

14.1. The thesis for his/her Master's degree should be of such a nature as to indicate a student's potentialities for conduct of independent research. The thesis shall be on topic falling within the field of the major subject and shall be the result of the student's own work. A certificate to this effect duly endorsed by the Major Advisor (Chairman) shall accompany the thesis.

14.2 The research credits registered in the last semester of post graduate programmes should be evaluated only at the time of the submission of thesis, by the advisory committee. Students can submit the thesis at the end of the final semester. If a post graduate student has completed the thesis before the closure of the final semester, the chairman can convene the advisory committee meeting and take decision on the submission of thesis provided the student satisfies 80 per cent attendance requirement. Two copies of the thesis should be submitted in paper pack for evaluation to the HOD.

14.3 The thesis shall contain a certificate from the supervisor specifying that the thesis submitted is a record of research work done by the candidate during the period of study under him/her, and that the thesis has not previously formed the basis for the award of any Degree, Diploma, Associateship, Fellowship or similar title. A statement from the supervisor indicating the extent to which the thesis represents independent work on the part of the candidate should also be made including free from plagiarism **above the specified level.**

14.4 The thesis shall also contain a declaration by the candidate that the work reported in the thesis has been carried out by the candidate himself/herself and that the

material from other sources, if any, is duly acknowledged and no part of the thesis is plagiarized **more than 25 %.**

15. Grace period

15.1 Students can avail a grace period up to a month for submission of thesis/project report after the closure of final semester by paying necessary fine as prescribed by the University. If a student is not able to submit the thesis within a month grace period, the student has to re-register the credits in the forthcoming semester. The student (s) who re-register the credits after availing the grace period will not be permitted to avail grace period.

15.2 Based on the recommendation of advisory committee and the Head of the Department, the Dean, can sanction the grace period. A copy of the permission letter along with the receipt for payment of fine as prescribed by the University should accompany the thesis while submission.

16. Submission of thesis after re-registration

The minimum of 80 per cent attendance requirement for submitting the thesis after, re-registration need not be insisted for those students who have fulfilled the minimum academic and residential requirement i.e. 2 years (4 semesters) and completed the minimum credit requirements for getting Degree.

17. Publication of articles

Part of the thesis may also be published in advance with the permission of the HOD. If any part is published the fact should be indicated in the certificate given by the chairman that the work has been published in part/full in the scientific or popular journals, proceedings, etc. The copies are to be enclosed in the thesis at the time of submission.

18. Evaluation of Thesis

18.1 The thesis submitted in partial fulfillment of a Master's degree shall be evaluated by an external examiner. The external examiner shall be a specialist in the student's major field of study from outside Annamalai University and shall be appointed by the University as per the recommendation of the Head of the Department.

18.2 The external examiner will send the evaluation report in duplicate one marked to the Controller of Examination and another to the Head of the Department along with the corrected copy of the thesis. If the report is favourable, Viva-Voce will be arranged by the Head of the Department concerned and conducted by the Advisory Committee along with the external examiner. The chairman of the advisory committee shall send the recommendations of the examining committee to the Controller of Examinations through Head of the Department after the student duly carries out the corrections/ suggestions mentioned by the external examiner (a certificate to be enclosed along with the recommendation). On the unanimous recommendation of the committee and with the approval of the University, the degree shall be awarded to the candidate.

18.3 In case of rejection of the thesis by the external examiner the Head of the Department concerned and Advisory Committee refer the thesis for valuation by

a second external examiner. If the second external examiner recommends the thesis for acceptance, Viva-Voce will be conducted.

18.4 If the revision of the thesis is recommended for repeating experiments, field trial etc., resubmission must be done by the candidate concerned after a minimum of six months. The revised version should be sent to the examiner who recommended revision.

18.5 After incorporating the suggestions of the examiners and those received at the time of viva-voce, two hard bound copies of thesis should be submitted to the Department (one to the scholar and one to the chairperson) and two soft copies in CDs to the University. At the time of final submission, the advisory committee members should certify the corrections and suggestions carried out as indicated by the examiners. However, fellowship holder has to submit a hard bound copy also as per the need, 3 copies of abstract of thesis (in 10-15 lines), 2 copies of the summary of the findings both in Tamil and English and also in C.D. form.

19. Revision of thesis

If an examiner recommends for revision of thesis the following norms will be adopted.

19.1 For revision of draft, the thesis should be resubmitted after a minimum of one month from the date of communication from the controller of examination

19.2 At the time of submission, the advisory committee should give certificate for carrying out the corrections/recommendations. The resubmitted copies of thesis should be got corrected carrying out the necessary corrections indicated by the external examiner and necessary certificates obtained from the chairman and HOD before the conduct of the final viva-voce.

19.3 A fine prescribed by the University to be collected from the students at the time of resubmission of thesis.

20. Failure to appear for final Viva-voce/ Non submission of thesis after viva-voce.

20.1 If a candidate fails to appear before the examining committee for final viva-voce, on the date fixed by the HOD the following are the time frame and penalty.

20.2 The re-viva-voce must be completed within two years. An amount of fine prescribed by the University must be charged to the candidate.

20.3 After successful completion of thesis final viva-voce if a student fails to submit the corrected version of the thesis within 15 days, he/she will be levied a fine prescribed by the University at the time of sending the proposal for result declaration.

21. Internship during Masters programme

Internship for Development of Entrepreneurship in Agriculture (IDEA)

Currently, a provision of 30 credits for dissertation work in M.Sc. programmes helps practically only those students who aspire to pursue their career in academic/ research. There is hardly any opportunity/ provision under this system to enhance the entrepreneurship skills of those students who could start their own enterprise or have adequate skills to join the industry.

Therefore, in order to overcome this gap, an optional internship/ in-plant training (called as IDEA) in lieu of thesis/ research work is recommended which will give the students an opportunity to have a real-time hands-on experience in the industry.
It is envisaged that the internship/ in-plant training would enhance the interactions between academic organizations and the relevant industry. It would not only enable the development of highly learned and skilled manpower to start their-own enterprises but also the industry would also be benefitted through this process. This pragmatic approach would definitely result in enhanced partnerships between academia and industry.

The main objectives of the programme:

1. To promote the linkages between academia and industry
2. To establish newer University – Cooperative R&D together with industry for knowledge creation, research and commercialization
3. Collaboration between Universities and industries through pilot projects
4. To develop methods for knowledge transfer, innovation and networking potential
5. To enhance skill, career development and employability

Following criteria for IDEA will be taken into consideration:

- At any point of time there will not be more than 50% of students who can opt under IDEA
- Major Advisor will be from Academia and Co-advisor (or Advisory Committee member) from industry
- Total credits (30) will be divided into 20 for internship/ in-plant training and 10 for writing the report followed by viva-voce similar to dissertation
- Work place will be industry; however, academic/ research support would be provided by the University or both. MoU may be developed accordingly
- The IPR, if any, would be as per the University policy

22. Result notification

22.1 After the completion of each semester, the student will be given the statement of marks by the Controller of Examinations.

22.2 The transcript will be prepared by Controller of Examinations. The various subjects taken by a student along with the credits and the grade obtained shall be shown on his transcript. Based on the total credits admitted, the final Grade Point Average shall be calculated and given.

23. Award of Medals

Medal should be awarded only if the student is a rank holder and secures at least 8.5 OGPA, clears all courses in first attempt and in the programme having a batch of at least three students.

*****

M.Sc. (Hort.) in Floriculture and Landscaping

Courses with Credit Load

I) Course work	
Major Courses	**20**
Minor Courses	**08**
Supporting Courses	**06**
Common Courses	**05**
Seminar	**01**
II) Thesis Research / IDEA	**30**
Total credits	**70**

Distribution Pattern of Courses and Credit (For Research Program)

Semester	Major Courses	Minor Courses	Supporting Courses	Common Courses	Seminar	Research	Credit Load
I	8	-	6	2	-	2	18
II	12	-	-	2	-	6	20
III	-	6	-	1	1	10	18
IV	-	2	-	-	-	12	14
Credit Load	**20**	**8**	**6**	**5**	**1**	**30**	**70**

Distribution Pattern of Courses and Credit (For IDEA Program)

Semester	Major Courses	Minor Courses	Supporting Courses	Common Courses	Seminar	IDEA	Credit Load
I	8	-	6	2	-	-	16
II	12	-	-	2	-	-	14
III	-	6	-	1	1	10	18
IV	-	2	-	-	-	10 +10	22
Credit Load	**20**	**8**	**6**	**5**	**1**	**30**	**70**

Distribution Pattern of Courses and Credit (M.Sc. (Hort.) in Floriculture and Landscaping)

S.no.	Course Code	Course Title	Credit Hours
		Major Courses	
1	FLA 501*	Systematics of Ornamental Plants	2+1
2	FLA 502*	Breeding of Ornamental Plants	2+1
3	FLA 503*	Commercial Production of Cut Flowers	2+1
4	FLA 504*	Commercial Production of Loose Flowers	2+1
5	FLA 505*	Ornamental Gardening and Landscaping	2+1
6	FLA 506	Indoor Plants and Interiorscaping	1+1
7	FLA 508	Turf Grass Management	2+1
8	FLA 510	Protected Cultivation of Flower Crops	2+1
9	FLA 511	CAD for Landscaping	1+2
		Minor Courses	
10	FLA 509	Value Addition in Floriculture	2+1
11	FLA 507	Nursery Management in Ornamental Plants	2+1
12	FLA 512	Seed Production in Flower Crops	1+1
		Supporting courses	
13	STA 501	Statistical Methods for Applied Sciences	2+1
14	COM 501	Information Technology in Agriculture	2+1
		Common Courses	
15	PGS 501	Agricultural Research, Research Ethics and Rural Development Programmes	1+0
16	PGS 502	Technical Writing and Communications Skills	1+0
17	PGS 503	Basic Concepts in Laboratory Techniques	0+1
18	PGS 504	Library and Information Services	1+0
19	PGS 505	Intellectual Property and its Management in Agriculture	1+0

20	FLA 591	Seminar	0+1
21	FLA 599	Research	30

*Compulsory courses

Programme Outcomes (POs)
PO 1. Students will have core knowledge leading to awareness on advancements in the field of Vegetable Science including crop production, soil fertility, crop protection, crop improvement. Biotechnology, post-harvest technologies and economics of cultivation.
PO 2. Students will have understanding and skill on experimental tools in biological sciences, analytical techniques for plant and soil samples, microbial technologies, biotechnological breeding methods, statistical tools & analysis, research data computation, etc, required for higher learning in Vegetable Science.
PO3. Students will be mastering the modern horticulture techniques of crop production, water, soil & nutrient management, plant protection, crop improvement and ecosystem restoration.
PO 4. Students be able design and execute individual research project, write concise & persuasive research articles and communicate effectively with their scientific colleagues, farmers and the general public.
PO 5. Students become eligible to work in commercial horticultural units, research project, post-harvest industries and POS.be able to address complex problems taking into account related ethical , social , legal , economic , and environmental issues.

PO and CO Mapping Matrix

AFFINITY LEVELS	
1	**Low**
2	**Moderate/ Medium**
3	**Substantial /High**

SEMESTER WISE DISTRIBUTION OF COURSES (RESEARCH)

Sl. No.	Course Title	Credit hours
	I Semester	
1.	Major Courses	8
2.	Supporting Courses	
	STA 501 - Statistical Methods for Applied Sciences	3
	COM 501 - Information Technology in Agriculture	3
3.	Common Courses	
	PGS 501 - Agricultural research, research ethics and rural development programmes	1
	PGS 502 - Technical writing and communications skills	1
4.	FLA 599 Research	2
	Total	**18**
	II Semester	
1.	Major Courses	12
2.	Common Courses	
	PGS 503 - Basic Concepts in Laboratory Techniques	1
	PGS 504 - Library and information services	1
3.	FLA 599 Research	6
	Total	**20**
	III Semester	
1.	Minor courses	6
2.	Common course	
3.	PGS 505 - Intellectual property and its management in agriculture	1
4.	Disaster Management (1+ 0)	-
5.	Constitution of India (Contact hour 1+ 0)	-
6.	FLA 591 Seminar	1
7.	FLA 599 Research	10
8.	Value Added Course (3+0) (https://annamalaiuniversity.ac.in/studport/value_added_crs.php)	-
		18
	IV Semester	
1.	Minor course	2
2.	FLA 599 Research	12 (8+4)
		14

SEMESTER WISE DISTRIBUTION OF COURSES (IDEA)

Sl. No.	Course Title	Credit hours
	I Semester	
1.	Major Courses	8
2.	Supporting Courses	
3.	STA 501 - Statistical Methods for Applied Sciences	3
4.	COM 501 - Information Technology in Agriculture	3
5.	Common Courses	
6.	PGS 501 - Agricultural research, research ethics and rural development programmes	1
7.	PGS 502 - Technical writing and communications skills	1
8.	FLA 599 IDEA	
	Total	**16**
	II Semester	
1.	Major Courses	12
2.	Common Courses	
3.	PGS 503 - Basic Concepts in Laboratory Techniques	
4.	PGS 504 - Library and information services	1
5.	FLA 599 IDEA	
	Total	**14**
	III Semester	
1.	Minor courses	6
2.	Common course	
3.	PGS 505 - Intellectual property and its management in agriculture	1
4.	Disaster Management (1+ 0)	-
5.	Constitution of India (Contact hour 1+ 0)	-
6.	FLA 591 Seminar	1
7.	FLA 599 IDEA	10
8.	Value Added Course (3+0) (https://annamalaiuniversity.ac.in/studport/value_added_crs.php)	-
	Total	**18**
	IV Semester	
1.	Minor course	2
2.	FLA 599 IDEA	20 (10+10)
	Total	**22**

ANNEXURE-1

PROFORMA FOR FORMATION OF RESEARCH ADVISORY COMMITTEE

(**To be sent before the end of I Semester**)

1. Name of the student:

2. Enrolment number: Reg. No.:

3. Degree:

4. Subject:

5. Advisory Committee:

S.No.	Advisory Committee	Name, Designation and Department	Signature
1.	Chairperson		
2.	Members		
	Additional Member		
	Reasons for additional Member		

Professor and Head

Additional members may be included only in the allied faculty related to thesis research with full justification at the time of sending proposals (Program of research).

ANNEXURE-II

PROFORMA FOR CHANGE IN THE RESEARCH ADVISORY COMMITTEE

1. Name of the student:
2. Enrolment number: Reg. No.
3. Subject:
4. Degree:
5. Proposed Change:

Advisory Committee	Name and designation	Signature
a. Existing member		
b. Proposed member		

6. Reasons for change

Chairperson

Signature of Professor and Head

ANNEXURE-III

PROFORMA FOR OUTLINE OF RESEARCH WORK (ORW)
(To be sent before the end of I Semester)

1. Name:
2. Enrolment number: Reg. No.
3. Degree:
4. Subject:
5. Date of Joining:
6. Title of the research project:
7. Objectives:
8. Duration:
9. Review of work done:
10. Broad outline of work/methodology:
11. Semester wise break up of work:

Signature of student

Approval of the advisory committee

Advisory committee	Name	Signature
Chairperson		
Members		
1.		
2.		

Professor and Head

ANNEXURE-IV

PROFORMA FOR CHANGE IN OUTLINE OF RESEARCH WORK (ORW)

1. Name:

2. Enrolment number: Reg. No

3 Degree:

4 Subject

5 Reasons for change:

6 Proposed change in the approved Program of research:

7 Number of credits completed so far Under the approved program:

8 a. Whether already earned credits are to be retained or to be deleted:

c. if retained, justification:

Signature of the student

Approval of the Advisory Committee

Advisory committee	**Name**	**Signature**
Chairperson		
Members		
Intra		
Inter		

Professor and Head

ANNEXURE-V

DEPARTMENT OF HORTICULTURE

PROFORMA FOR EVALUATION OF SEMINAR

1. Name of the candidate:
2. Register Number :
3. Degree programme :
4. Semester :
5. Topic of the seminar and credit :
6. Distribution of marks

Distribution of marks	Max Marks				
i. Literature coverage	40				
ii. Presentation	30				
iii. Use of audio – visual aid	10				
iv. Interactive skills	20				
Total	100				
Name					
Designation		Chairperson	Intra Member	Inter Member	Average
Signature					

Grade point:

Head of the Department

ANNEXURE-VI

PROFORMA FOR REGISTRATION OF RESEARCH CREDITS

(**To be given during first week of semester**)

PART A: PROGRAM

Semester: Year: Date of registration:

1. Name of the student and
2. Enrolment number:/Reg. No.:
3. Total research credits completed so far:
4. Research credits registered during the semester:
5. Program of work for this semester (list out the Items of research work to be undertaken during the semester) :

Approval of advisory committee

Advisory committee	**Name**	**Signature**
Chairperson		
Members		
1. Intra		
2. Inter		

Professor and Head

Approval may be accorded within 10 days of registration

ANNEXURE-VII

PROFORMA FOR EVALUATION OF RESEARCH CREDITS

PART B EVALUATION

(**Evaluation to be done before the closure of Semester**)

Date of Commencement semester: Date of closure of semester:

Date of evaluation:

1. Name of the student
2. Enrolment number: Reg. No.:
3. Total research credits completed so far:
4. Research credits registered during the semester:
5. Whether the research work has been carried out as per the approved program:
6. If there is deviation specify the reasons:
7. Performance of the candidate: SATISFACTORY /NOT SATISFACTORY

Approval of the advisory committee

Advisory committee	**Name**	**Signature**
Chairperson		
Members		
1.Intra		
2.Inter		

Professor

ANNEXURE- VIII
ANNAMALAI UNIVERSITY
FACULTY OF AGRICULTURE
DEPARTMENT OF HORTICULTURE
PROFORMA FOR EVALUATION OF THESIS

1. Name of the examiner:
2. Postal Address:
3. Telephone/Mobile:
4. E-Mail:
5. Name of the candidate:
6. Title of the thesis:
7. Date of receipt of the thesis copy:
8. Date of dispatch of the detailed report and thesis by the examiner to the Controller of Examinations:
9. Examiner's recommendations choosing one of the following based on quality of thesis

   Please give your specific recommendation (select any one decision from the list below) with your signature and enclose your detailed report in separate sheet(s).

a. I recommend that the thesis entitled ----------
   ----
   submitted by ---------- be accepted for award of the Degree of MASTER OF SCIENCE (AGRICULTURE / HORTICULTURE / AGRI BUSINESS MANAGEMENT) of Annamalai University, Annamalainagar.

(OR)

b. I do not recommend the acceptance of the thesis entitled.

   ---------- Submitted by ----------
   for award of the Degree of MASTER OF SCIENCE (AGRICULTURE / HORTICULTURE / AGRI BUSINESS MANAGEMENT) of Annamalai University, Annamalainagar. (Please specify reasons)

Date:

Signature with Office Seal:

Note- Please enclose a detailed report in duplicate duly signed by you giving the merits and demerits of the thesis on the choice of problem, review of literature, methods followed, results and discussion, etc.

PROFORMA FOR REPORT OF THE FINAL VIVA VOCE EXAMINATION

The meeting of the Examining Committee for Mr./Ms. ----------M.Sc. (Ag.) Student Reg.No. ---------- Majoring in ----------was held at ----------a.m /p.m on ----------

The following members were present:

1.---------- : Chairperson

2.---------- : Member

3.---------- : Member

4.----------: External examiner

The committee took note of the report of the external examiner Dr. ----------recommending the thesis for acceptance.

The final viva voce examination for the candidate was conducted by the members of the Advisory Committee and external examiner. The candidate has secured satisfactory/unsatisfactory

The Committee recommends/ does not recommend unanimously the award of Degree of M.Sc. (Ag.).to Mr./Ms.----------

1. Chairman
2. Member
3. Member
4. External examiner:

The original report from the External Examiner is attached herewith

Professor and Head

Chairperson of the Advisory Committee

CERTIFICATE FOR HAVING CARRIED OUT THE SUGGESTIONS OF THE EXTERNAL EXAMINER AND ADVISORY COMMITTEE

Certified that Mr./ Ms. ---------- Reg. No. ----------has carried out all the corrections and suggestions as pointed out by the External examiner and the Advisory Committee. He / She has submitted **TWO** copies of his/ M.Sc. (Ag.). /(Hort.)/Agri Business Management thesis in hard bound cover and two soft copies in CD format, two copies each of the abstract of thesis and summary of the findings both in Tamil and English in CD format.

Chairperson

Professor and Head

ANNAMALAI UNIVERSITY

DEPARTMENT OF HORTICULTURE
FACULTY OF AGRICULTURE

Date:

CERTIFICATE

This is to certify that the thesis entitled "----------" submitted in partial fulfillment of the requirements for the award of the degree of ---------- to Annamalai University, Annamalainagar is a record of bonafide research work carried out by ----------, under my guidance and supervision and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has been published / not been published in part or full in any scientific or popular journals or magazines.

Chairman

1. Chairman :
2. Member :
3. Member :
4. External examiner:

Course Title with Credit Load

M.Sc. (Hort.) in Floriculture and Landscaping

Sl. No.	Course Code	Course Title	Credit Hours
		Major Courses (20 Credits)	
1.	FLA 501*	Systematics of Ornamental Plants	2+1
2.	FLA 502*	Breeding of Ornamental Plants	2+1
3.	FLA 503*	Commercial Production of Cut Flowers	2+1
4.	FLA 504*	Commercial Production of Loose Flowers	2+1
5.	FLA 505*	Ornamental Gardening and Landscaping	2+1
6.	FLA 506	Indoor Plants and Interiorscaping	1+1
7.	FLA 507	Nursery Management in Ornamental Plants	2+1
8.	FLA 508	Turf Grass Management	2+1
9.	FLA 509	Value Addition in Floriculture	2+1
10.	FLA 510	Protected Cultivation of Flower Crops	2+1
11.	FLA 511	CAD for Landscaping	1+2
12.	FLA 512	Seed Production in Flower Crops	1+1
		Minor Courses	08
		Supporting Courses	06
		Common compulsory courses	05
	FLA 591	Seminar	0+1
	FLA 599	Research	0+30
		Total Credits	**70**

*Compulsory among major courses

FLA 501 SYSTEMATICS OF ORNAMENTAL PLANTS (2+1)

Learning objectives

- To familiarize students about the taxonomy of different ornamental plants
- To know about the classification of ornamental plants
- To learn the nomenclature of various ornamental plants
- To study the descriptors of different ornamental crops
- To become proficient in molecular techniques in modern systematics.

Theory

Unit - I: **Principles of Classification & Nomenclature**

Principles of classification; different methods of classification; nomenclature systems; salient features of international code of nomenclature of flower and ornamental crops; International Code, Treaties, International and National Organisations, Biodiversity Act, Identification features, descriptors; Red Book, Registration (NBPGR, PPVFRA, NBA).

Unit - II: **Families of Ornamental Plants 1**
History, origin, distribution, evolution, hotspots of flower and ornamental crops and botanical description of families, genera, species, taxonomy and cytogenetics - Rosaceae, Asteraceae, Caryophyllaceae, Orchidaceae
Unit - III: **Families of Ornamental Plants 2**
Aracaceae, Liliacae, Acanthaceae, Palmaceae
Unit - IV: **Families of Ornamental Plants 3**
Asparagaceae, Malvaceae, Musaceae, Oleaceae, Iridaceae
Unit - V: **Molecular Techniques**
Importance of molecular markers in evolution of flower and ornamental crops; molecular markers as an aid in characterization and taxonomy of flower and ornamental crops.

Practicals
Floral biology and taxonomic description of rose, jasmine, chrysanthemum, marigold, orchids, carnation, gerbera, anthurium, tuberose, China aster, lilium, gypsophila – cryopreservation and tissue culture repository – methods of preparation of herbarium and specimens.

Lesson plan

1. History, origin, hotspots
2. Principles of classification; different methods of classification
3. Nomenclature systems
4. Salient features of international code of nomenclature of flower and ornamental crops
5. Treaties
6. International and National Organisations
7. Biodiversity Act
8. Identification features, descriptors
9. Red Book, Registration (NBPGR, PPVFRA, NBA)
10. Description of family - Rosaceae
11. Description of important genera - Rosaceae
12. Description of family - Asteraceae
13. Description of important genera - Asteraceae
14. Description of family - Oleaceae
15. Description of important genera - Oleaceae
16. Description of family – Description of family - Orchidaceae
17. **Mid semester examination**
18. Description of important genera - Monopodial orchids under Orchidaceae
19. Description of important genera - Sympodial orchids under Orchidaceae
20. Description of family - Caryophyllaceae
21. Description of important genera - Caryophyllaceae
22. Description of family - Aracaceae
23. Description of important genera - -Aracaceae
24. Description of family – Liliacae

25. Description of important genera - Liliacae
26. Description of family -Acanthaceae
27. Description of important genera - Acanthaceae
28. Description of family - Palmae (Arecaceae)
29. Description of important genera - Palmae (Arecaceae)
30. Description of family and important genera -Asparagaceae
31. Description of family and important genera - Malvaceae
32. Description of family and important genera - Musaceae
33. Description of family and important genera - Iridaceae
34. Importance of molecular markers in characterization, taxonomy and evolution of flower and ornamental crops

Practical

1. Floral biology and taxonomic description of Rosaceae - Rose
2. Floral biology and taxonomic description of Asteraceae - Chrysanthemum
3. Floral biology and taxonomic description of Asteraceae - Marigold
4. Floral biology and taxonomic description of Asteraceae - Gerbera, China aster
5. Floral biology and taxonomic description of Oleaceae - Jasmine
6. Floral biology and taxonomic description of Adparagaceae - Tuberose
7. Floral biology and taxonomic description of Orchidaceae - Monopodial Orchids
8. Floral biology and taxonomic description of Orchidaceae - Sympodial Orchids
9. Floral biology and taxonomic description of Araceae - Anthurium
10. Floral biology and taxonomic description of Caryophyllacea - Carnation, Gypsophila
11. Floral biology and taxonomic description of Liliaceae - Llilium
12. Floral biology and taxonomic description of Acanthaceae - Crossandra
13. Floral biology and taxonomic description of Acanthaceae - Iridaceae
14. Floral biology and taxonomic description of Apocynaceae - Nerium
15. Methods of preparation of herbarium and specimens
16. Cyropreservation and tissue culture repository
17. **Final practical examination**

Course outcome

CO 1– will be able to categorize ornamental plants based on taxonomy
CO 2 – will become familiarize with the classification of ornamental plants
CO 3 – to be conversant with the family and genera of different ornamental crops
CO 4 –will become well verse with the floral biology of different flower crops
CO 5 – will be capable of working on molecular techniques in modern systematics

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	1	3	2	1	-
CO 2	1	3	2	1	-
CO 3	2	3	2	1	-
CO 4	2	3	2	1	-
CO 5	3	3	2	1	-

References

1. Bhattacharya, B. & Johri, B.M. 2004. Flowering Plants: Taxonomy and Phylogeny. Narosa Publ. House, New Delhi, India. pp.753.
2. Dutta, A.C. 1986. A Class Book of Botany. Oxford Univ. Press, Kolkata, India.
3. Pandey, B.P. 2013. Taxonomy of Angiosperms. S. Chand & Co. pp. 608.
4. Rajput, C.B.S. &Haribabu, R.S. 2014. Citriculture, Kalyani Publ., New Delhi, India.
5. Spencer, R.R., Cross, R. & Lumley, P. 2007. Plant Names. 3rd Ed. A Guide to Botanical Nomenclature. CSIRO Publ., Australia., 176 p.
6. Vasistha, B.B. 1998. Taxonomy of Angiosperms. Kalyani Publ., New Delhi, India.

Suggested websites

1. https://www.britannica.com
2. https://www.gardenersworld.com
3. https://drawbotanical.com
4. http://www.sci.sdsu.edu
5. https://kpu.pressbooks.pub

FLA 502 BREEDING OF ORNAMENTAL PLANTS (2+1)

Learning objectives

- To impart comprehensive knowledge about the principles and practices of breeding of flower crops and ornamental plants.
- Students will know about breeding techniques of commercial flower cropsand ornamental plants.
- Students will update knowledge on IPR issues and Course Outcomes of crop improvement programmes in Indian floriculture.
- To impart skill in hybrid flower and ornamental seed production.
- Will know about the biotechnology interventions used in breeding of ornamental plants

Theory

Unit I: **Principles of Plant Breeding**

Origin, evolution, distribution, introduction, domestication and conservation of ornamental crops; genetic resources (species, varieties, ecotypes, etc.)

Unit II: **Intellectual Property and Plant Breeders Rights**

Introduction and initiatives in IPR and PBR of ornamental crops.

Unit III: **Genetic Mechanisms and Inheritance**

Breeding objectives, reproductive barriers (male sterility, incompatibility) in major ornamental crops; inheritance of important traits, genetic mechanisms associated with flower colour, size, form, doubleness, fragrance, plant architecture, post-harvest life, abiotic and biotic stress tolerance/resistance.

Unit IV: **Breeding Methods**

Breeding methods suitable for sexually, asexually propagated flower crops, self- and cross-pollinated crops - pedigree selection, backcross, clonal selection, polyploidy and mutation breeding, heterosis and F1 hybrids.

Unit V: **Role of Biotechnology**

Role of biotechnology in improvement of flower crops including somaclonal variation, in vitro mutagenesis, in vitro selection, genetic engineering, molecular markers, etc.

Crops

Rose, chrysanthemum, carnation, gerbera, gladiolus, orchids, anthurium, lilium, marigold, jasmine, tuberose, dahlia, gaillardia, crossandra, aster, etc., Flowering annuals: petunia, zinnia, snapdragon, stock, pansy, calendula, balsam, dianthus, etc. Important ornamental crops like aglaonema, diffenbachia, hibiscus, bougainvillea, kalanchoe, etc.

Practicals

Floral biology of important ornamental crops – Cytology and cytogenetics – selfing and crossing procedures – Evaluation of hybrid progenies – Induction of mutants through physical and chemical mutagens – In vitro selection, genetic engineering – Induction o fpolyploidy – DUS testing

Lesson plan

1. Principles of plant breeding – Cytogenetics, modes of reproduction (pollination); origin, evolution, distribution, introduction, domestication and conservation of ornamental crops
2. Introduction and initiatives in Intellectual Property Rights (IPR) and Plant Breeders' Rights (PBR) of ornamental crops
3. Rose – Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, fragrance, plant architecture, post-harvest life, abiotic and biotic stress tolerance/resistance)
4. Rose - breeding methods: introduction, hybridization, mutation, biotechnological approaches
5. Jasmine - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, fragrance, plant architecture, post-harvest life, abiotic and biotic stress tolerance/resistance)
6. Jasmine - breeding methods: clonal selection, open pollinated seedling selection, hybridization, mutation breeding, ploidy breeding
7. Chrysanthemum - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, plant architecture, post-harvest life, abiotic and biotic stress tolerance/resistance)
8. Chrysanthemum - breeding methods: introduction, hybridization, mutation breeding, biotechnological approaches
9. Marigold - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, post-harvest life, abiotic and biotic stress tolerance/resistance)
10. Marigold - breeding methods: introduction, hybridization, mutation breeding

11. Tuberose- Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, post-harvest life, abiotic and biotic stress tolerance/resistance)
12. Tuberose - breeding methods: hybridization, mutation breeding
13. Crossandra - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding methods: hybridization, mutation breeding
14. Nerium – Breeding objectives, reproductive barriers, breeding methods
15. Carnation - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, post-harvest life, abiotic and biotic stress tolerance/resistance)
16. Carnation - Breeding methods: introduction, hybridization, mutation breeding
17. **Mid semester examination**
18. Gerbera- Breeding objectives, reproductive barriers, inheritance of important traits (flower colour, size, form, post-harvest life, abiotic and biotic stress tolerance/resistance)
19. Gerbera - Breeding method: hybridization
20. Orchids - Genetic resources, breeding objectives, pollination adaptations in orchid genera, genetic mechanisms associated with important traits (flower colour, size, form, post-harvest life)
21. Orchids – Breeding methods: hybridization; breeding in important genera – Dendrobium, Cymbidium
22. Orchids - Breeding in important genera – Oncidium, Phalaenopsis, Vanda
23. Anthurium - Genetic resources, breeding objectives, reproductive barriers, genetic mechanisms associated with important traits; breeding method - hybridization
24. Anthurium - breeding method: hybridization
25. Gladiolus - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding method: hybridization
26. Lilium - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding methods: hybridization, polyploidization, biotechnological approaches
27. Heliconia - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits, genetic mechanisms associated with important traits; breeding methods
28. China aster - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding method: hybridization
29. Hibiscus - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding methods: hybridization, mutation breeding
30. Bougainvillea - Genetic resources, breeding objectives, reproductive barriers, inheritance of important traits; breeding methods: clonal selection, open pollinated seedling selection, hybridization, mutation breeding
31. Breeding objectives, breeding methods in flowering annuals - petunia, zinnia, snapdragon, stock
32. Breeding objectives, breeding methods in flowering annuals -pansy, calendula, balsam, dianthus, etc

33. Breeding objectives, breeding methods: important ornamental crops - dahlia, Gaillardia
34. Breeding objectives, breeding methods: important ornamental crops -aglaonema, diffenbachia, kalanchoe, etc.

Practical

1. Floral biology of rose and jasmine
2. Floral biology of chrysanthemum and tuberose
3. Cytology and cytogenetics - Chromosome counting through root tip mitosis
4. Cytology and cytogenetics - Assessment of pollen viability and germination
5. Selfing and crossing procedures in Tuberose
6. Selfing and crossing procedures in Anthurium
7. Evaluation of hybrid progenies - for quantitative and qualitative traits
8. Evaluation of hybrid progenies - for pests and diseases
9. Induction of mutants - Gamma irradiation
10. Induction of mutants – Chemical mutation
11. In vitro selection techniques - callus induction and subculture
12. Techniques in genetic engineering -DNA extraction, PCR techniques
13. Induction of polyploidy -in vivo techniques
14. Induction of polyploidy -in vitro techniques
15. DUS testing in Jasmine
16. DUS testing in chrysamthemum
17. **Final practical examination**

Course outcome

CO 1- The students must be able to demonstrate different breeding techniques in flower crops.
CO 2- The students will become capable of working on breeding programmes in flower crops.
CO 3- Will get insights into IPR issues in commercial flower crops.
CO 4- The students will be able to develop hybrids in flower crops.
CO 5- The students will develop the required skills in conventional and advanced breeding.

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	3	3	1		-
CO 2	3	3	1	1	-
CO 3	-	-	2	2	3
CO 4	3	3	1	1	-
CO 5	3	3	1	1	-

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Suggested websites

1. http://www.jhortscib.com/
2. http://journal.ashspublications.org/
3. http://www.actahort.org/

FLA 503 COMMERCIAL PRODUCTION OF CUT FLOWERS (2+1)

Learning objectives

- To impart basic knowledge about the importance and production dynamics of cut flowers grown in India
- The students will gain knowledge about the production technologies of cut flowers for Indian and export market
- The students will study the concepts and principles behind the hi-tech production of cut flowers
- The students will learn the post harvest management and international standards of cut flowers
- To provide better understanding about the marketing channels and constraints

Theory

Unit I: **Scope and Scenario**

National and International scenario, importance and scope of cut flower trade, constraints for cut flower production in India.

Unit II: **Growing Environment**

Soil analysis, soil health card, Growing environment, open cultivation, protected cultivation, soil/media requirements, land preparation, planting methods, influence of light, temperature, moisture, humidity and microclimate management on growth and flowering.

Unit III: **Crop Management**

Commercial Flower production – Commercial varieties, water and nutrient management, fertigation, weed management, crop specific practices, ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding. Use of growth regulators, physiological disorders and remedies, IPM and IDM.

Unit IV: **Flower Regulation**

Flower forcing and year-round/offseason flower production through physiological interventions, chemical regulation, environmental manipulation.

Unit V: **Post Harvest Management and Marketing**

Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Methods of delaying flower opening, Pre- cooling, pulsing, packing, storage and transportation. Marketing, export potential, institutional support, Agri Export Zones, 100% Export Oriented units, Crop Insurance.

Crops

Rose, chrysanthemum, gladiolus, tuberose, carnation, gerbera, orchids, lilium, anthurium, china aster, alstroemeria, bird of paradise, heliconia, alpinia, ornamental ginger, dahlia, gypsophila, solidago, limonium, stock, cut greens and fillers.

Practicals

Identification of varieties - propagation - microclimate management - training and pruning techniques - pinching, deshooting, disbudding, desuckering - practices in manuring, drip and fertigation, foliar nutrition, growth regulator application - harvesting techniques, post-harvest handling, cold chain - economics, Project preparation for regionally important cut flowers, crop specific guidelines for project financing (NHB guidelines) - visit to commercial cut flower units - case studies.

Lesson plan

1. Scope and importance of cut flowers, area and production, scenario of national and international cut flower trade, production constraints for cut flower production in India

2. Soil analysis, soil health card, open cultivation, protected cultivation, influence of light, temperature, moisture, humidity and microclimate management on growth and flowering
3. Rose – commercial varieties, propagation, soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, training and pruning, pinching, disbudding, deshooting, dead shoot removal, soil loosening on beds, bending, defoliation, bending, desuckering, disbudding, use of growth regulators, physiological disorders and remedies, nutritional disorders, IPM and IDM
4. Rose – standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
5. Chrysanthemum - commercial varieties, propagation, environmental manipulation (with emphasis on photoperiod regulation), soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, pinching, disbudding, desuckering, disbudding, blindness, use of growth regulators, physiological disorders and remedies, nutritional disorders, IPM and IDM
6. Chrysanthemum - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
7. Gladiolus - commercial varieties, propagation, soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, staking, use of growth regulators, physiological disorders and remedies, nutritional disorders, fluoride injury, IPM and IDM
8. Gladiolus – standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
9. Tuberose - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM
10. Tuberose - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
11. Carnation – commercial varieties, propagation, soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, netting, pinching, disbudding, use of growth regulators, physiological disorders and remedies, nutritional disorders, IPM and IDM
12. Carnation - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
13. Gerbera - commercial varieties, propagation, soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, leaf pruning, pinching, disbudding, use of growth regulators, physiological disorders and remedies, nutritional disorders, IPM and IDM
14. Gerbera - standards and grades, harvest indices, harvesting techniques, post-harvest

handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing

15. Orchids - commercial varieties, propagation, growing media and planting, water and nutrient management, fertigation, weed management, repotting, splitting or division of plants, use of growth regulators, physiological disorders and remedies, nutritional disorders, IPM and IDM
16. Orchids - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
17. **Mid semester examination**
18. Lilium - commercial varieties, propagation, soil fumigation, land preparation and planting, water and nutrient management, fertigation, weed management, staking, leaf scorch, bud drop and bud desiccation, use of growth regulators, nutritional disorders, IPM and IDM
19. Lilium - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
20. Anthurium - commercial varieties, propagation, growing media, soil fumigation, system of planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM
21. Anthurium - standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
22. China aster - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, pinching, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre-cooling, pulsing, packing, storage, transportation and marketing
23. Alstroemeria - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, mulching, staking, pinching, shading, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
24. Bird of Paradise - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre- cooling, pulsing, packing, storage, transportation and marketing
25. Heliconia - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, postharvest handling, methods of delaying flower opening, pre-cooling, pulsing, packing, storage, transportation and marketing

26. Alpinia and Ornamental ginger - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
27. Dahlia - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, postharvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
28. Gypsophila - commercial varieties, propagation, soil fumigation, land preparation and method of planting, open field cultivation, water and nutrient management, fertigation, weed management, netting, pinching, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
29. Solidago - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, postharvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
30. Limonium - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, postharvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
31. Stock - commercial varieties, propagation, land preparation and planting, water and nutrient management, fertigation, weed management, use of growth regulators, nutritional disorders, IPM and IDM, standards and grades, harvest indices, harvesting techniques, post-harvest handling, pre-cooling, pulsing, packing, storage, transportation and marketing
32. Cut greens and fillers - varietal wealth and diversity, propagation and nursery management, climate and soil factors influencing production, land preparation and planting, water and nutrient management, fertigation, weed management, use of plant growth regulators, harvest indices, harvesting techniques, post-harvest handling, storage, transportation and marketing
33. Export potential, IPR issues, institutional support for cut flower production
34. Agri Export Zones, 100% Export Oriented Units and Crop Insurance for cut flower production

Practical

1. Study of varieties of rose, chrysanthemum, carnation, gerbera, gladiolus, anthurium and orchids
2. Propagation techniques of rose, chrysanthemum, carnation, gerbera, gladiolus, anthurium and orchids

3. Propagation techniques of open field cut flowers
4. Microclimate management in rose, chrysanthemum, carnation and gerbera
5. Microclimate management in gladiolus, anthurium and orchids
6. Training and pruning techniques in rose, chrysanthemum, carnation, gerbera and open field cut flowers
7. Pinching, deshooting, disbudding, desuckering in rose, chrysanthemum, carnation, gerbera and open field cut flowers
8. Practices in layout of drip and fertigation systems
9. Practices in manuring, foliar nutrition and growth regulator application in cut flowers
10. Post-harvest handling and cold chain management in rose, chrysanthemum, carnation, gerbera, gladiolus, anthurium and orchids
11. Post-harvest handling and cold chain management in open field cut flowers
12. Project preparation for regionally important commercial cut flowers (rose, chrysanthemum, carnation, gerbera) with cost benefit analysis, crop specific guidelines for project financing (NHB guidelines)
13. Project preparation for regionally important commercial cut flowers (open field cut flowers) with cost benefit analysis, crop specific guidelines for project financing (NHB guidelines)
14. Visit to commercial cut flower units
15. Visit to commercial cut flower units
16. Case studies for regionally important commercial cut flower
17. **Final practical examination**

Course outcome

CO 1- The student will have knowledge on advanced production technologies in growing cut flower crops.
CO 2- The students will be able to diagnose production problems in cut flowers.
CO 3- The students will become capable of managing a floriculture unit from planting to harvest.
CO 4- The students can prepare a project proposal for establishing a cut flower industry
CO 5- The students can identify the avenues for marketing of cut flowers.

CO-PO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	3	3	3	-	1
CO 2	3	3	3	-	1
CO 3	3	3	2	2	3
CO 4	-	-	2	3	3
CO 5	3	3	-	2	3

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1. Arora, J.S. 2010. Introductory Ornamental Horticulture. Kalyani Publishers. 6th edition, pp.230.
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Suggested websites

1. http://www.jhortscib.com/
2. http://journal.ashspublications.org/
3. http://www.actahort.org/

FLA 504 COMMERCIAL PRODUCTION OF LOOSE FLOWERS (2+1)

Learning objectives

- To impart basic knowledge about the importance of loose flowers cultivation in Indian context
- The student will gain basic knowledge about the production technologies of loose flowers and flower forcing techniques
- Students will grasp the knowledge on production problems in loose flowers.
- The student will the post harvest management of loose flowers
- To provide better understanding about the marketing channels and constraints

Theory

Unit I: **Scope and Scenario**:
Scope, scenario and importance of loose flowers, constraints and opportunities in loose flower production.
Unit II: **Growing Environment**:
Nursery management, pro-tray nursery under shade nets, soil and climate requirement, Field preparation, systems of planting.
Unit III: **Crop Management**:
Soil analysis, soil health card, water and nutrient management, weed management, training and pruning, special horticultural practices such as pinching and disbudding, use of growth regulators, physiological disorders and remedies, INM, IPM and IDM.
Unit IV: **Crop Regulation**:

Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation.

Unit V: **Post Harvest Management**:

Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packaging and storage. Marketing: Important local markets, Export potential, transportation and marketing, APMC and online trading, institutional support, Crop Insurance.

Crops

Rose, jasmine, chrysanthemum, marigold, tuberose, china aster, crossandra, gaillardia, spider lily, hibiscus, nerium, barleria, celosia, gomphrena, Madar (Calotropis gigantea), Nyctanthes (Harsingar), Tabernaemontana (Crape jasmine), lotus, water lily, michelia (Champa), gardenia, ixora and balsam.

Practicals

Identification of species and varieties - Propagation and nursery management - Training and pruning techniques - Fertigation, foliar nutrition, growth regulator application - Crop protection - Pinching, disbudding, staking, harvesting techniques - Post-harvest handling, storage and cold chain - Project preparation for regionally important commercial loose flowers. crop specific guidelines for project financing (NHB guidelines) - Cost Economics - Exposure Visits to fields

Lesson plan

1. Scope, scenario and importance of loose flower production
2. Constraints and opportunities in loose flower production
3. Soil analysis, soil health card, nursery management, pro-tray nursery under shade nets for loose flower production
4. Rose - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management, training and pruning,
5. Rose - special horticultural practices such as pinching and disbudding, use of growth regulators, physiological disorders and remedies, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing, extraction of rose oil
6. Jasmine – species - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management, pruning
7. Jasmine - use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing, concrete extraction
8. Chrysanthemum - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management,
9. Chrysanthemum - special horticultural practices such as pinching and disbudding, use of growth regulators, physiological disorders and remedies, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
10. Marigold - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management,

11. Marigold - special horticultural practices such as pinching and disbudding, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing, extraction of pigments
12. Tube rose - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing, concrete extraction
13. Tube rose - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing, concrete extraction, lifting and storage of bulbs
14. China aster - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, special horticultural practices such as pinching and disbudding, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
15. Crossandra - commercial varieties, propagation, soil and climate requirement, field preparation, systems of planting, water and nutrient management, weed management
16. Crossandra - staking – pinching – removal of spent spikes, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
17. **Mid semester examination**
18. Gaillardia - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, special horticultural practices such as pinching and disbudding, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
19. Spider lily - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
20. Hibiscus - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, pruning, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
21. Nerium - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, pruning, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
22. Barleria - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
23. Celosia - commercial varieties, propagation, soil and climate requirement, field

preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing

24. Gomphrena - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
25. Madar (*Calotropis gigantea*), Nyctanthes (Harsingar), Crape jasmine (*Tabernaemontana divaricata*) - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
26. Ixora - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, pruning, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
27. Lotus - commercial varieties, propagation, soil and climate requirement, field preparation, planting, nutrient management, weed management, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
28. Water lily - commercial varieties, propagation, soil and climate requirement, field preparation, planting, nutrient management, weed management, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
29. Michelia (Champa) - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
30. Gardenia and balsam - commercial varieties, propagation, soil and climate requirement, field preparation, planting, water and nutrient management, weed management, use of growth regulators, INM, IPM and IDM, harvest indices, harvesting techniques, packaging, transportation and marketing
31. Flower forcing and year round flowering in loose flower production
32. Production of loose flowers for special occasions through physiological interventions and chemical regulation
33. Important local markets and export potential for loose flowers
34. Transportation and marketing, APMC in loose flower production, Online trading, institutional support, Crop Insurance for loose flower production

Practical

1. Identification of species and varieties for rose, jasmine, chrysanthemum, marigold, tuberose, China aster, crossandra, hibiscus, nerium, lotus, water lily and ixora
2. Propagation and nursery management for commercial production of loose flowers
3. Training and pruning techniques for loose flowers

4. Practices in layout of drip and fertigation systems
5. Practices in foliar nutrition and growth regulator application in loose flowers
6. Crop protection for rose, jasmine, chrysanthemum, marigold, tuberose, China aster, crossandra, gaillardia, spider lily, hibiscus, nerium
7. Crop protection for barleria, celosia, gomphrena, madar (Calotropis gigantea), nyctanthes (Harsingar), Ervatamia (Chandni), ixora, lotus, water lily, Michelia (Champa), gardenia, Ixora and balsam
8. Pinching, disbudding, staking, harvesting techniques for loose flowers
9. Post-harvest handling, storage and cold chain management for rose, jasmine, chrysanthemum, marigold, tuberose, China aster, crossandra, gaillardia, spider lily, hibiscus, nerium
10. Post-harvest handling, storage and cold chain management for barleria, celosia, gomphrena, madar (Calotropis gigantea), nyctanthes (Harsingar), ervatamia (Chandni), ixora, lotus, water lily, Michelia (Champa), gardenia, ixora and balsam
11. Project preparation for regionally important commercial loose flowers (Rose, jasmine, chrysanthemum, marigold, tuberose) crop specific guidelines for project financing (NHB guidelines)
12. Project preparation for regionally important commercial loose flowers, (Crossandra, hibiscus, Nerium, lotus, water lily and Ixora) crop specific guidelines for project financing (NHB guidelines)
13. Preparation of cost Economics for important commercial loose flowers (Rose, jasmine, chrysanthemum, marigold, tuberose)
14. Preparation of cost Economics for important commercial loose flowers (crossandra, hibiscus, nerium, lotus, water lily and ixora)
15. Exposure Visits to fields
16. Exposure Visits to fields
17. **Final practical examination**

Course outcome

CO 1- The student will have knowledge on advanced production technologies in growing flower crops.
CO 2- The students will be able to diagnose production problems in loose flowers.
CO 3- The students will become capable of managing an open field floriculture unit from planting to harvest.
CO 4- The students can work out the cost economics of loose flower cultivation
CO 5- The students can identify the avenues for marketing of loose flowers.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	-	1
CO 2	3	3	3	-	1
CO 3	3	3	2	2	3
CO 4	-	-	2	3	3
CO 5	3	3	-	2	3

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Suggested websites

1. http://www.jhortscib.com/
2. http://journal.ashspublications.org/
3. http://www.actahort.org/
4. https://agritech.tnau.ac.in/horticulture/horti_index.html

FLA 505 ORNAMENTAL GARDENING AND LANDSCAPING (2+1)

Learning objectives

- To educate the students on landscape designing principles and execution of design.
- To understand about gardening concepts, styles and components.
- To learn the landscape designing process and execution of design.
- To learn about establishment and management of landscape project.
- To make on-site analysis, designing with garden elements and principles manually and using softwares.

Theory

Unit I: **Styles and Types of Gardens**

Historical background of gardening, Importance and scope of ornamental gardening, styles and types of gardens, formal and informal style gardens. English, Mughal, Japanese, Persian, Spanish, Italian, French, Hindu and Buddhist gardens.

Unit II: **Garden Components (Living and Non-Living)**

Arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, colour wheels, clock garden, bamboo groves, bonsai; Non-living components likepath, garden gate, fencing, paving and garden features like fountains, garden seating, swings, lanterns, basins, bird baths, sculptures, waterfalls, bridge, steps, ramps, Lawn -genera and species, establishment and maintenance.

Unit III: **Specialized Gardens**

Specialized gardens such as vertical garden, roof garden, terrace garden, water garden, sunken garden, rock garden, shade garden, temple garden, sacred gardens (with emphasis on native plants), Zen garden.

Unit IV: **Garden Design and Site Analysis**

Elements and principles of landscape design.-Basic drawing skills, use of drawing instruments garden symbols, steps in preparation of garden design, programmes phase, design, phase, etc. Organization of spaces, visual aspects of plan arrangement- view, vista and axis. Principles of circulation, site analysis and landscape, water requirement, use of recycled water.

Unit V: **Landscaping for Different Situations**

Urban landscaping, Landscaping for specific situations such as residential, farm houses, institutions, corporate sector, industries, hospitals, roadsides, traffic islands, Children parks, public parks, xeriscaping, airports, railway station and tracks, river banks and dam sites and IT/ SEZ parks. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening.

Practicals

Graphic language and symbols in landscaping, study of drawing instruments viz., 'T' square, setsquare, drawing board, etc. Identification of various types of ornamental plants for different gardens and occasions, Preparation of land, planning, layout and planting, deviations from landscape principles, Case study, Enlargement from blue print. Landscape design layout and drafting on paper as per the scale ,Preparation of garden models for home gardens, farm houses, industrial gardens, institutional gardens, corporate, avenue planting, practices in planning and planting of special types of gardens. Burlapping, lawn making, planting of edges, hedges, topiary, herbaceous and shrubbery borders, creation of formal and informal gardens Project preparation on landscaping for different situations.

Lesson plan

1. Historical background of gardening, Importance and scope of ornamental gardening
2. Styles and types of gardens, formal and informal style gardens.
3. Different type of gardens-English, Mughal, Japanese gardens
4. Different type of gardens -Persian, Spanish, Italian, French gardens

5. Different type of gardens -Hindu and Buddhist gardens
6. Garden components -Arboretum, shrubbery
7. Garden components –Fernery, palmatum
8. Garden components - arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs
9. Garden components - annuals, flower borders and beds, ground covers, carpet beds, colour wheels, clock garden, bamboo groves, bonsai
10. Non -living components - path, garden gate, fencing, paving and garden features like fountains, garden seating, swings, lanterns, basins, bird baths, sculptures, waterfalls, bridge, steps, ramps.
11. Lawn -genera and species, establishment and maintenance
12. Specialised gardens -vertical garden
13. Specialised gardens- roof garden, terrace garden
14. Specialised gardens- water garden, sunken garden
15. Specialised gardens- rock garden
16. Specialised gardens -shade garden, temple garden, sacred gardens (with emphasis on native plants), Zen garden
17. **Mid semester examination**
18. Principles and elements of landscaping
19. Basic drawing skills, use of drawing instruments garden symbols,
20. Steps in preparation of garden design, programmes phase, design, phase, etc.
21. Organization of spaces, visual aspects of plan arrangement- view, vista and axis. Principles of circulation
22. Site analysis for landscape
23. Water requirement, use of recycled water in landscaping
24. Urban landscaping for urban areas, corporate sector
25. Landscaping for residential, farm houses
26. Landscaping for Institutions
27. Landscaping for Industries
28. Landscaping for hospitals, roadsides, traffic islands, Children parks, public parks
29. Landscaping for airports, railway station and tracks, river banks and dam sites and IT/ SEZ parks.
30. Xeriscaping-plan and lay out
31. Bio-aesthetic planning,
32. Landscaping for Eco- tourism, theme parks
33. Indoor gardening-principles and practices
34. Therapeutic gardening

Practical

1. Graphic language and symbols in landscaping, study of drawing instruments viz., 'T' square, setsquare, drawing board, etc.
2. Identification of various types of ornamental plants for different gardens and occasions
3. Preparation of land, planning, layout and planting, deviations from landscape principles
4. Case study with successful landscapists
5. Enlargement from blue print
6. Landscape design layout and drafting on paper as per the scale ,drafting on paper as per

the scale

7. Preparation of garden models for home gardens, farm houses
8. Preparation of garden models for industrial gardens, institutional gardens
9. Preparation of garden models for institutional gardens
10. Preparation of garden models for corporate, avenue planting, practices in planning and planting of special types of gardens
11. Burlapping, planting of edges, hedges, topiary, herbaceous and shrubbery borders
12. Practices in lawn making and maintenance
13. Project preparation on landscaping for creation of formal gardens
14. Project preparation on landscaping for creation of informal gardens
15. Visit to parks
16. Visit to botanical gardens
17. **Final practical examination**

Course outcome

CO 1- The students will be apprised of different types of gardens and have a thorough understanding of principles of landscape gardening.

CO 2- The students will be able to identify different soft and hard landscapeelements.

CO 3- The students will be able to develop the skills of doing site analysis and assessing the consumer preferences.

CO 4- The students will become capable of designing a garden project and preparethe cost economics.

CO 5- The students will be able to develop skills for landscaping under different situations and layout of garden components.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	3	2
CO 2	3	3	3	3	1
CO 3	3	3	1	3	3
CO 4	3	2	1	3	3
CO 5	2	2	1	3	3

References

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3. Grewal, H. S. & Singh, P. 2014. Landscape Designing and Ornamental Plants. Kalyani Publ. Woodrow, M. G.1999. Gardening in India. Biotech Books, New Delhi, India.
4. Lauria, A. & Victor, H.R. 2001. Floriculture-Fundamentals and Practices. Agrobios Publ., Jodhpur
5. Misra, R. L. &Misra, S. 2012. Landscape Gardening. Westville Publ. House, New Delhi, India.
6. Nambisan, K.M.P.1992. Design Elements of Landscape Gardening. Oxford & IBH Publ.

Co., New Delhi, India.
7. Randhawa, G.S. & Mukhopadhyay, A. 1986. Floriculture in India. Allied Publ.
8. Sabina ,G.T. & Peter, K.V. 2008. Ornamental Plants for Gardens. New India Publ. Agency, New Delhi, India.
9. Singh, A. &Dhaduk, B. K. 2015. A Colour Handbook: Landscape Gardening. New India Publ. Agency, New Delhi, India.
10. Valsalakumari, P. K., Rajeevan, P. K., Sudhadevi, P. K. & Geetha C.K. 2008. Flowering Trees. New Inda Publ. Agency, New Delhi, India.

Suggested websites

1. http://www.jhortscib.com/
2. http://journal.ashspublications.org/
3. http://www.actahort.org/

FLA 506 INDOOR PLANTS AND INTERIORSCAPING (1+1)

Learning objctives

- To facilitate deeper understanding of the benefits of indoor plants
- To provide knowledge on selection of indoor plants
- To develop skills for designing interiorscaping
- To design special gardens for different situations
- To develop business models for interiorscaping

Theory

Unit I: Importance and scope

Importance and scope of indoor plants and Interiorscaping, Indoor plants and Indoor air quality.

Unit II: Classification and principles

Factors affecting growth, development and flowering of Indoor plants. Classification of indoor plants based on light, temperature, humidity and pollution tolerance, Description and cultivation of various indoor plants. Principles of Interiorscaping, Role in pollution mitigation.

Unit III: Cultural operations

Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants, Nursery standards.

Unit IV: Special gardens

Special gardens including miniature gardens and plant stand. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai. Vertical gardens- History, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting.

Unit V: Marketing

Marketing channels, Business models including plant rentals.

Practical

Identification of important house plants - Media and containers – Propagation - Cultural operations, maintenance and economics of indoor plants - Models for Interiorscaping - Familiarization with different indoor gardens - Making of terrariums, bottle garden, dish garden and their economics - Making of vertical gardens and economics - Exposure visits

Lesson plan

1. Importance and scope of indoor plants and Interiorscaping
2. Indoor plants and Indoor air quality
3. Factors affecting growth, development and flowering of Indoor plants
4. Classification of indoor plants based on light, temperature, humidity and pollution tolerance
5. Description and cultivation of various indoor plants
6. Principles of Interiorscaping
7. Role of Interiorscaping in pollution mitigation
8. Containers and substrates, preparation of growing media
9. **Mid semester examination**
10. Propagation, training, grooming, nutrition, management of disease, pests and weeds
11. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation.
12. Media standards, Nursery and Export standards for potted plants, Nursery standards
13. Special gardens including miniature gardens and plant stand
14. Presentations like dish, terrarium, bottle gardens, hanging baskets, window boxes and Bonsai
15. Vertical gardens- History, planting material, structures, containers, substrate
16. Vertical gardens- water and nutrient management, supplemental lighting
17. Marketing channels, Business models including plant rentals

Practical

1. Identification of important house plants
2. Identification of important house plants
3. Media and containers
4. Propagation of indoor plants
5. Cultural operations, maintenance and economics of indoor plants
6. Cultural operations, maintenance and economics of indoor plants
7. Models for Interiorscaping
8. Models for Interiorscaping
9. Familiarization with different indoor gardens
10. Familiarization with different indoor gardens
11. Making of terrariums, bottle garden, dish garden and their economics
12. Making of terrariums, bottle garden, dish garden and their economics
13. Making of vertical gardens and economics
14. Making of vertical gardens and economics
15. Exposure visits
16. Exposure visits

17. **Final practical examination**

Course outcome

After successful completion of this course, the students are expected to develop
CO 1. Deep understanding and knowledge of principles affecting indoor cultivation including vertical gardens
CO 2. Develop required skills in interiorscaping
CO 3. To develop expertise on maintenance of indoor plants
CO 4. Will get hands on experience in creating special gardens
CO 5. Develop required entrepreneurial acumen

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	2	2
CO 2	3	3	2	2	2
CO 3	3	3	2	2	2
CO 4	3	3	2	2	2
CO 5	3	3	1	3	2

References

1. Barbara P. 2005. The Complete Houseplant Survival Manual. Storey Publ., New Adams.
2. Randhawa GS and Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
3. Wallach C. 1995. Interior Decorating with Plants. McMillan Seed Production Co. Inc., New York.

FLA 507 NURSERY MANAGEMENT IN ORNAMENTAL PLANTS (2+1)

Learning objectives

- To familiarize with principles and practices of propagation
- To develop skills in nursery management for ornamental plants
- To teach the students about the methods of propagation for various ornamental plants
- To get exposure on automation in nursery management
- To inculcate the students for planning and designing layout for nursery

Theory

Unit I: Scenario of nursery industry and sexual propagation

Importance and present scenario and status of nursery industry in India and in the world, life cycles in plants, Propagation methods, Factors influencing seed germination of flower crops, dormancy, seed quality, packing, storage, certification, testing. Hormonal regulation of germination and seedling growth.

Unit II: Asexual propagation

Methods of asexual propagation, rooting of soft and hard wood cutting under mist. Role of Plant growth regulators. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principles and methods, budding and grafting – selection of elite mother plants. Stock, scion and inter stock, relationship – Incompatibility.

Unit III: Micropropagation

Micro-propagation – principles and concepts, commercial exploitation in flower crops. Techniques - in vitro clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micropropagules.

Unit IV: Growing structures

Growing structures like mist chambers, tunnels, lath house, net house, growing media types, soil less culture and containers. Automation in nursery management.

Unit V: Sanitary and phyto-sanitary issues

Nursery – types, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, PPV&FR act and Quarantine system in India. Important quarantine pests and diseases, sanitary and phyto-sanitary issues threats to nursery Industry. Standards: Nursery standards, Hi-tech nurseries, garden centers.

Practicals

Anatomical studies in rooting of cutting and graft union - Identification and production of plug plants, seedlings and saplings - Preparation of growing media and use of PGRs - Practice of propagation through specialized structures cuttings, layering, budding and Grafting - Case studies - Micropropagation of ornamental crops and hardening - Visit to tissue culture labs and nurseries – Economics.

Lesson plan

1. Importance, Status, present scenario of nursery industry in India and in the world
2. Life cycles in plants for ornamental crops
3. Propagation methods and Factors influencing seed germination, Dormancy, seed quality of ornamental crops
4. Packing, storage, certification, testing of ornamental plants
5. Hormonal regulation of germination and seedling growth in ornamental crops
6. Methods of asexual propagation in flower crops - Asexual propagation - Rooting of soft and hard wood cutting under mist and Role of Plant growth regulators for ornamental crops
7. Layering – principles and methods Budding and grafting – selection of elite mother plants Stock, scion and inter stock, relationship – Incompatibility
8. **Mid semester examination**
9. Physiological, anatomical, Biochemical aspects of root induction in cuttings of ornamental crops
10. Micro-propagation – principles and concepts, Commercial exploitation in flower crops
11. Techniques - in vitro clonal propagation, direct organogenesis, Embryogenesis, micrografting, meristem culture
12. Hardening, packing and transport of micropropagules

13. Growing structures like mist chambers, tunnels, lath house, net house,growing media types, soil less culture and containers used in nursery - Automation in nursery management
14. Sanitary and phyto-sanitary issues: Nursery – types, components, planning and layout Nursery management practices for healthy propagule production
15. Nursery Act, PPV&FR act, Quarantine system for import/export of ornamental crops in India
16. Important quarantine pests and diseases of ornamental crops in nursery
17. Sanitary and phyto-sanitary issues threats to nursery Industry Standards: Nursery standards, Hi-tech nurseries, garden centers

Practical

1. Anatomical studies in rooting of cutting
2. Anatomical studies in rooting graft union
3. Identification and production of plug plants
4. Identification and production of seedlings and saplings
5. Preparation of growing media for ornamental crops
6. Preparation and use of PGRs for ornamental crops
7. Practice of propagation through specialized structures cuttings, layering for ornamental crops
8. Practice of propagation through specialized structures budding and grafting for ornamental crops
9. Case studies
10. Case studies
11. Practices in micropropagation - Media preparation
12. Practices in micrografting, meristem culture tissue culture practices in ornamental crops
13. Hardening of micro propagated ornamental crops
14. Visit to tissue culture labs for of ornamental crops
15. Visit to commercial nurseries of ornamental crops
16. Economics in establishment of ornamental nursery
17. **Final practical examination**

Course outcome

After successful completion of this course,
CO 1. The students will develop thorough understanding of nursery management in ornamental crops
CO 2. Hone adequate skill in propagation and management
CO 3. To become well verse with nursery act and quarantine procedures
CO 4. To develop acumen in automation of nursery industry
CO 5. Empower the students with the knowledge to start an enterprise

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	2	1
CO 2	3	3	2	3	1
CO 3	2	-	2	2	3
CO 4	3	3	2	2	1
CO 5	2	2	2	3	3

References

1. Adriance, G.W. &Brison, F. R. 2000. Propagation of Horticultural Plants. Biotech Books, New Delhi, India.
2. Bose, T. K., Mitra, S. K. & Sadhu, M. K. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, Kolkata, India.
3. Chadha, K. L., Ravindran, P. L. & Leela Sahijram. 2000. Biotechnology in Horticulture and Plantation Crops. Malhotra Publ. House, New Delhi, India.
4. Davies, Fred T. Jr., Geneve, R. L., Wilson, S. B., Hartmann, H. T. & Kester, D. L. 2018.
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7. Rajan, S. & Baby, L.M. 2007. Propagation of Horticultural Crops. New India Publ. Agency, New Delhi, India. pp. 251.
8. Singh, S.P. 1989. Mist Propagation. Metropolitan Book Co., New Delhi, India.

Suggested websites

1. https://www.scielo.br/j/oh/a/FBHC5TfpTz4tHJCrWfWnVhy/?lang=en
2. https://www.iht.edu.in/ornamental-plant-nursery/

FLA 508 TURF GRASS MANAGEMENT (2+1)

Learning objectives

- Students will know the nuances of turf management.
- The student will gain knowledge on scope and importance of different turf grasses and their features.
- The students will learn about turf establishment methods
- The students will be exposed to the maintenance procedure of turf under different conditions.
- Will have exposure to different automation equipments used in turf industry.

Theory

Unit I: Prospects and basic requirement

History, present status and prospects of turf industry; basic requirements, site selection and evaluation, concepts of quality of soil pertaining to turf grass establishment, criteria for evaluation of turf quality.

Unit II: Types of turf grasses

Types, species, varieties, important breeders, grasses for different locations and conditions and their compatible groupings as per climatic conditions; Turfing for roof gardens.

Unit III: Operations and management

Preparatory operations; Turf establishment methods such as seeding, sprigging/dibbling, plugging, sodding/turfing, turf plastering, instant turfing (portable), hydro-seeding, synthetic turfing. Turf management – Irrigation, drainage, nutrition, special practices like aerating, rolling, coring, dethatching, verticutting, soil top dressing, use of plant growth regulators and micronutrients, Turf mowing - mowing equipments, techniques to minimize wear and compaction, weed control, biotic and abiotic stress management in turfs, standards for turf, use of recycled water etc.

Unit IV: Making of different sports arenas

Establishment and maintenance of turfs for playgrounds, viz. golf, football, hockey, cricket, tennis, rugby, residential and public parks, turfing of Govt. & Corporate office gardens, event specific preparation, turf colourants.

Unit V: Automation

Different tools, gadgets and machinery used in turf industry - Seeders, lawn mowers, raking and rolling equipments, irrigation systems, irrigation automation

Practicals

Identification of turf grasses and turf machinery - Soil preparation, turf establishment methods, provision of drainage - Layout of macro and micro irrigation systems -Water and nutrient management - Special practices – mowing, raking, rolling, soil top dressing, weed management - Biotic and abiotic stress management - Project preparation for turf establishment - Visit to parks, model cricket grounds and golf courses, airports, corporates, Govt. organizations - Rejuvenation of lawns - Turf economics.

Lesson plan

1. History, present status of turf industry
2. Scope, importance and prospects of turf industry
3. Basic requirements of turf industry
4. Site selection and evaluation of turf industry
5. Concepts of quality of soil pertaining to turf grass establishment
6. Criteria for evaluation of turf quality
7. Types of turf grasses: species, varieties
8. Important breeders, grasses for different locations and conditions
9. Turf grass compatibility groupings as per climatic conditions
10. Turfing for roof gardens

11. Turf establishment methods viz., seeding, sprigging/dibbling
12. Turf establishment methods viz., plugging, sodding/turfing
13. Turf establishment methods viz., instant turfing (portable), hydro-seeding, synthetic turfing
14. Turf management – Irrigation, drainage, nutrition
15. Turf management – special practices viz., aerating, rolling, coring
16. Turf management – special practices viz., dethatching, verti-cutting
17. **Mid semester examination**
18. Soil top dressing, use of plant growth regulators for Turf grass management
19. Micronutrients for Turf grass management
20. Mowing equipments in Turf grass management
21. Techniques to minimize wear and compaction in Turf grass management
22. Weed control in Turf grass management
23. Biotic stress management in turfs
24. Abiotic stress management in turfs
25. Standards for turf grass management
26. Use of recycled water in turf grass management
27. Establishment and maintenance of turfs for golf grounds
28. Establishment and maintenance of turfs for football, hockey, cricket grounds
29. Establishment and maintenance of turfs for tennis, rugby sports
30. Establishment and maintenance of turfs for residential and public parks
31. Establishment and maintenance of turfs for turfing of Govt. & Corporate office gardens
32. Establishment and maintenance of turfs for event specific preparation, turf colourants
33. Automation and different tools, gadgets used in turf industry
34. Different machineries used in turf industry and irrigation systems

Practical

1. Identification of turf grasses and turf machinery
2. Soil preparation, turf establishment methods
3. Provision of drainage in Turf grass management
4. Layout of macro and micro irrigation systems in Turf grass management
5. Water management in Turf grass management
6. Nutrient management in Turf grass management
7. Special practices in Turf grass management – mowing, raking, rolling
8. Special practices in Turf grass management – soil top dressing, weed management
9. Biotic stress management in Turf grass management
10. Abiotic stress management in Turf grass management
11. Project preparation for turf establishment

12. Project preparation for turf establishment
13. Visit to parks, model cricket grounds and golf courses
14. Visit to airports, corporates, Govt. organizations
15. Rejuvenation of lawns
16. Turf economics
17. **Final practical examination**

Course outcome

After successful completion of this course, the students are expected to
CO 1- Get deep understanding and knowledge of different types of grasses and their management
CO 2- Developing skills for turfing of different arenas
CO 3- Develop required entrepreneurial acumen
CO 4- The students will be able to prepare a turf establishment project and to execute the same.
CO 5- The students will able to manage turf in commercial units.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	-
CO 2	3	3	1	2	-
CO 3	2	2	2	3	3
CO 4	3	3	3	3	1
CO 5	3	3	3	3	1

References

1. Aldous, D.1999. International Turf Management Handbook. CRC Press. pp.368.
2. Beard, J. B. 1972. Turf Grass Science and Culture. Pearson. 1 st edition, pp. 672.
3. Chawla, S. L., Patil, S., Patel, M. A., Patel, R. B. & Patel, R. M. 2013. Turf grass Management. Publised by NAU, Navsari.
4. Emmons, R. 2007. Turf grass Science and Management. Cengage Learning Publ. 4 th edition, pp. 592.

Suggested websites

1. www.lawn.co.uk
2. www.the-landscape-design-site.com
3. www.gardenworld.co.uk
4. dir.gardenweb.com/directory/d-home.html

FLA 509 VALUE ADDITION IN FLORICULTURE (2+1)

Learning objectives

- The Students will understand the importance and scope of value addition in flowers.
- The student will gain knowledge on principles and practices in value addition of flowers.
- The students will learn about different flower arrangement and dry flower making
- The students will be exposed to various essential oils and pigment extraction procedures.
- The students will become conversant in dying techniques of flower crops

Theory

Unit I: **Scope and scenario**

Scope and prospects of value addition, National and global scenario, production and exports. Types of value added products, techniques of value addition including tinting.

Unit II: **Value addition in loose flowers**

Value addition in loose flowers and product development- Gulkhand, floral tea, rose oil, rose water, Pankhuri, floral dyes, rose sherbet, floral ice creams, sweets, etc.

Unit III: **Floral Arrangements**

Selection of containers and accessories for floral products and decorations. Flower arrangement, styles, ikebana schools (ikenobo, ohara, sogetsu, etc.), Ikebana- moribana, nagiere, contemporary style.

Unit IV: **Dry flowers**

Dry flowers– Identification and selection of flowers and plant parts; Raw material procurement, preservation and storage; tips for collecting dry flower making, selection of stages for picking of flowers for drying, Techniques in dry flower making – Drying, glycerising, bleaching, dyeing, embedding, pressing; Accessories; Designing and arrangement – dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths; petal embedded handmade papers, Packaging and storage. Post drying management including moisture, pests and molds.

Unit V: **Extraction and Dying**

Essential oils; Selection of species and varieties (including non-conventional species), extraction methods, Packing and storage, Aromatherapy. Types of pigments, carotenoids, anthocyanins, chlorophyll, betalains; Significance of natural pigments as nutraceuticals, Extraction methods and applications in food, pharmaceutical and poultry industries. Synthetic and Natural dyes, dying techniques, colour retention,

Practical

Practices in preparation of different type of flower arrangements including bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands with fresh flowers - Techniques in flower arrangement and floral decoration - Identification of plants for dry flower making - Practices in dry flower making; Preparation of dry flower baskets, bouquets, potpourri, wall hangings, button holes, greeting cards, wreaths, etc. - Essential oil extraction units - Extraction of pigments - Visit to dry flower units - Economics of value-added products

Lesson plan

1. Scope and prospects of value addition of flower crops
2. National and global scenario, production and exports
3. Types of value-added products
4. Techniques of value addition including tinting
5. Value addition in loose flowers and product development- Gulkhand, floral tea, rose oil, rose water, Pankhuri
6. Value addition in loose flowers and product development- floral dyes, rose sherbet, floral ice creams, sweets, etc
7. Selection of containers and accessories for floral products and decorations
8. Flower arrangement, styles, ikebana schools (ikenobo, ohara, sogetsu, etc.)
9. Flower arrangement - Ikebana- moribana
10. Flower arrangement - nagiere, contemporary style.
11. Dry flowers– Identification and selection of flowers and plant parts;
12. Dry flowers– Raw material procurement, preservation and storage;
13. Tips for collecting dry flower making,
14. Dry flowers– Selection of stages for picking of flowers for drying,
15. Techniques in dry flower making – Drying, glycerising
16. Techniques in dry flower making – bleaching, dyeing
17. Techniques in dry flower making – embedding, pressing;
18. **Mid semester examination**
19. Accessories used in dry flower making
20. Designing and arrangement – dry flower baskets, bouquets,
21. Designing and arrangement – pot-pourri, wall hangings, button holes,
22. Designing and arrangement – greeting cards, wreaths;
23. Designing and arrangement – petal embedded handmade papers, Packaging and storage.
24. Post drying management including moisture, pests and molds.
25. Essential oils; Selection of species and varieties (including non-conventional species),
26. Extraction methods of essential oils
27. Essential oils - Packing and storage
28. Aromatherapy
29. Types of pigments - carotenoids, anthocyanins, chlorophyll, betalains;
30. Significance of natural pigments as nutraceuticals
31. Extraction methods of natural pigments
32. Applications of natural pigments in food, pharmaceutical and poultry industries
33. Synthetic and Natural dyes used for dying
34. Dying techniques and colour retention in flowers

Practical

1. Practices in preparation of different type of flower arrangements – bouquets and button-holes
2. Practices in preparation of different type of flower arrangements - flower baskets
3. Practices in preparation of different type of flower arrangements - corsages
4. Practices in preparation of different type of flower arrangements - floral wreaths, garlands with fresh flowers
5. Techniques in flower arrangement
6. Techniques in floral decoration
7. Identification of plants for dry flower making
8. Identification of plants for dry flower making
9. Practices in dry flower making; Preparation of dry flower baskets, bouquets, potpourri,
10. Practices in dry flower making; Preparation of wall hangings, button holes, greeting cards, wreaths, etc.
11. Essential oil extraction units
12. Extraction of pigments
13. Extraction of pigments
14. Visit to dry flower units
15. Visit to dry flower units
16. Economics of value-added products
17. **Final practical examination**

Course Outcome

CO 1- Imbibe the skills for making various value-added products in flower crops.
CO 2- The students will gain skill in production of floral crafts and dry flower making.
CO 3- Will gain skill and proficiency in floral arrangements.
CO 4- Will become familiar with the pigment extraction methods
CO 5- Will develop entrepreneurial acumen

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	3	3	2	3	-
CO 2	3	3	2	3	-
CO 3	-	-	2	3	-
CO 4	3	3	2	3	-
CO 5	2	2	2	3	3

References

1. Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.

2. Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp.533 and pp.574. Malhotra Publ. House, New Delhi, India.
3. Lauria A and Victor HR. 2001. Floriculture-Fundamentals and Practices.Agrobios Publ., Jodhpur.
4. Nowak J and Rudnicki RM. 1990. Postharvest handling and storage of cut flowers, florist greens, and potted plants. Timber Press, USA. pp. 210.
5. Prasad S and Kumar U. 2003. Commercial Floriculture. Agrobios Publ., Jodhpur.
6. Reddy S, Janakiram T, Balaji T, Kulkarni S and Misra RL. 2007. Hi- Tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi, India.

Suggested websites

1. http//www.floralhome.com/natdry/html
2. www.aces.edu/pubs/docs
3. www.fao.org
4. http://indiamart.com/products/decorative-items/dry-flowers/storingpreserving
5. www.techno-preneur.net/information-desk/dry-flower.pdf
6. http://www.agcom. Purdue.edu /agcom/pubs
7. http://www.intechopen.com/books/natural-dyes

FLA 510 PROTECTED CULTIVATION OF FLOWER CROPS (2+1)

Learning objectives

- To understand the principles of protected cultivation
- To study different modes of protected cultivation
- To teach the students the techniques of environmental control in green house
- To develop skills in protected cultivation of flower crops
- To educate the students about automation in green house

Theory

Unit I: Prospects and types of protected structures

Prospects of protected floriculture in India; Types of protected structures – Glasshouse/ polyhouse, shadenet houses, mist chambers, lath houses, orchidarium, fernery, rain shelters, etc.

Unit II: Principles and design

Principles of designing and erection of protected structures; Low cost/ Medium cost/ High cost structures; Location specific designs; Structural components; Suitable flower and foliage plants for protected cultivation.

Unit III: Control of environment

Microclimate management and manipulation of temperature, light, humidity, air and CO_2; Heating and cooling systems, ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation, water harvesting.

Unit IV: Intercultural operations and crop regulation

Containers and substrates, media, soil decontamination, layout of drip and fertigation system, water and nutrient management, IPM and IDM, Crop regulation by chemical methods and special horticultural practices (pinching, disbudding, deshooting, deblossoming, etc.); Staking and netting, Photoperiod regulation.

Unit V: Greenhouse Automation and standards

Automation in greenhouses, sensors, solar greenhouses and retractable greenhouses, GAP/ Flower labels, Export standards, EXIM policy, APEDA regulations for export, Non-tariff barriers.

Crops: Rose, Chrysanthemum, Carnation, Gerbera, Orchids, Anthuriums, Lilium, Limonium, Lisianthus, heliconia, Cala lily, Alstromeria, etc.

Practical

Study of various protected structures - Design, layout and erection of different types of structures - Practices in preparatory operations, growing media, soil decontamination techniques - Microclimate management - Practices in drip and fertigation techniques, special horticultural practices - Determination of harvest indices and harvesting methods - Postharvest handling, packing methods - Economics of cultivation, Project preparation - Project Financing guidelines - Visit to commercial greenhouses

Lesson plan

1. Prospects of protected horticulture in India
2. Types of protected structures – Greenhouses and polyhouses
3. Types of protected structure- shade houses and rain shelters.
4. Designing and erection of protected structures
5. Greenhouse construction – loads- dead load, installation load, crop load or imposed load, snow load, wind load
6. Frames used for greenhouse construction - wood frames, metal or steel frames, pipe frame, angle iron, aluminum
7. Cladding/ glazing materials for different horticultural crops.
8. Low cost/Medium cost/High cost structures
9. Economics of cultivation under different types of structures.
10. Location specific designs, structural components
11. Suitable horticultural crops for protected cultivation
12. Environment control by management - manipulation of temperature, light, humidity
13. Environment control by management - manipulation of, air and CO2
14. Heating and cooling systems, ventilation, naturally ventilated greenhouses,
15. Fan and pad cooled greenhouses
16. Light regulation in protected structures
17. **Mid Semester Examination**
18. Containers and substrates suitable for horticultural crops
19. Soil fumigation/ decontamination methods.

20. Laying of drip and fertigation system
21. Nutrient management under protected structures
22. Water management of high value crops
23. Weed management of high value crops
24. Physiological disorders in flower crops and their management.
25. Nutrient deficiency in flower crops
26. Crop regulation by chemical methods
27. Photoperiod regulation in protected structures.
28. Supporting systems and special horticultural practices like pinching, disbudding, deshooting, deblossoming, etc.
29. Integrated pest management (IPM) of flower crops
30. Integrated disease management (IDM) of flower crops.
31. Harvest indices and harvesting techniques
32. Post-harvest handling techniques of flower crops.
33. Precooling, sorting, grading, packing, storage and quality standards
34. Export standards for cut flowers

Practical

1. Study of various protected structures
2. Design, layout and erection of different types of structures
3. Design, layout and erection of different types of structures
4. Practices in preparatory operations, growing media, soil decontamination techniques
5. Practices in preparatory operations, growing media, soil decontamination techniques
6. Microclimate management
7. Microclimate management
8. Practices in drip and fertigation techniques, special horticultural practices
9. Practices in drip and fertigation techniques, special horticultural practices
10. Determination of harvest indices and harvesting methods
11. Postharvest handling, packing methods
12. Economics of cultivation, Project preparation
13. Economics of cultivation, Project preparation
14. Project Financing guidelines
15. Visit to commercial greenhouses
16. Visit to commercial greenhouses
17. **Final practical examination**

COURSE OUTCOME

After successful completion of this course, the students are expected to be acquire

CO 1- Knowledge on types, design and principles of protected structures

CO 2- Thorough understanding of principles of microclimate management and crop management.

CO 3- Develop the required skills for designing a greenhouse

CO 4- Will be able to design micro irrigation and fertigation assembly

CO 5- Acquire skills on microclimate management, production management

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	3	3	2	2	-
CO 2	3	3	2	2	-
CO 3	2	2	2	2	2
CO 4	3	3	2	2	-
CO 5	3	3	2	2	3

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1. Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
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4. Chadha KL and Bhattacharjee SK. 1995. Advances in Horticulture: Ornamental Plants. Vol. XII, Parts 1 & 2. pp.533 and pp.574. Malhotra Publ. House, New Delhi, India.
5. Lauria A and Victor HR. 2001. Floriculture-Fundamentals and Practices.Agrobios Publ., Jodhpur.
6. Nelson PV. 2011. Green House Operation and Management. Pearson Publ. 7th edition, pp. 624.
7. Prasad S and Kumar U. 2003. Commercial Floriculture. Agrobios Publ., Jodhpur.
8. Randhawa GS and Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
9. Reddy S, Janakiram T, Balaji T, Kulkarni S and Misra RL. 2007. Hi- Tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi, India
10. Tiwari, G.N. 2003. Green House Technology for Controlled Environment. Narosa publishing house, NewDelhi.

FLA 511 CAD FOR LANDSCAPING (1+2)

Learning objectives

- To impart knowledge about Computer Aided Designing process for outdoor and indoorscaping.
- To make them familiarize with the AUTOCAD drawings (2D & 3D)
- To impart knowledge on designing landscaping with AutoCAD tools
- To make the students learn about various software's used in landscape designing
- To make them familiarize with 3D rendering and visualization and plan preparation for a landscape projects

Theory

Unit I: CAD Basics and Applications

Exposure to CAD (Computer Aided Designing) Applications of CAD in landscape garden designing- 2D drawing by Auto CAD- creating legends for plant and non-plant components.

Unit II: Introduction to Auto CAD tools

Commands in Auto CAD Auto CAD toolbars and icons--file handling functions- modifying tools- modifying comments - Point picking methods, Toolbars and Icons- isometric drawings- perspective views, blocks-drafting objects-Lines, Arc, Eclipse, etc., Array, polylines, attributes, exploring images into realistic views.

Unit III: Designing Landscape with AutoCAD

Designing with Auto CAD with base plan Using patterns in AutoCAD drawing- dimension concepts-base plan reading hyperlinking- script making- using productivity tools- e-transmit file- making sample drawing for outdoor and indoor gardens

Unit IV: Software's in Garden Designing

Softwares in Landscape designing Software handling for designing Landscape - ARCHICADD, Sketchup, Revit, Lands Design, Photoshop Maya, Lumion, Garden Planner, Dream Plan, Realtime Landscape Pro, 3D land-3D rendering, Terragen, Edificius LAND, Marshalls Garden visualize etc, Mobile apps-iScape, Pro Landscape companion etc.

Unit V: 3D rendering and Visualization

Plan preparation for various sites Basic requirements - dimensioning and detailing of designs- attribute settings of components- 3D visualization and tools for landscape preview- data management plotting and accessories for designing- inserting picture using photoshop and Coral Draw- making sample drawing for outdoor and indoor gardens.

Practical

Practices in drawing- dimension concepts-base plan reading point picking methods- using tool bars and icons- using modifying tools and modifying comments-AutoCAD toolbars and icons--file handling functions- modifying tools modifying comments- isometric drawings- perspective views isometric drawings using productivity tools- creation of garden components -detailing and visualization tools - using photoshop package for 3D picture insertion- practicing various softwares like ARCHICADD, Sketchup, Revit, Lands Design, Photoshop Maya, Lumion, Garden Planner, Dream Plan, Realtime Landscape Pro, 3D land-3D rendering,Terragen, Edificius LAND, Marshalls Garden visualize etc, Mobile apps -iScape, Pro Landscape companion for parks-

corporate- theme parks and ecotourism spots-home garden- institutional garden and special types of garden making sample drawing for indoor gardens.

Lesson plan

1. Exposure to CAD (Computer Aided Designing).
2. Applications of CAD in landscape garden designing: 2D drawing by AUTOCAD and 3D drawing.
3. Creating legends for plant and non-plant components
4. AutoCAD toolbars and icons- -file handling functions
5. Modifying tools- modifying comments
6. Isometric drawings- perspective views, blocks-drafting objects
7. Polylines, attributes, exploring images into realistic views
8. Using patterns in AutoCAD drawing- dimension concepts-base plan reading hyperlinking
9. **Mid -semester Examination**
10. Software handling for designing Landscape - ARCHICADD, Sketch up
11. Software handling for designing Landscape Revit, Lands Design, Photoshop Maya, Lumion
12. Software handling for designing Landscape -Garden Planner, Dream Plan, Realtime Landscape Pro, 3D Land
13. 3D rendering, Terragen, Edificius LAND, Marshalls Garden visualize etc
14. Mobile apps-iScape, Pro Landscape companion etc.
15. Basic requirements - dimensioning and detailing of designs- attribute settings of components
16. Plotting and accessories for designing- inserting picture using photoshop and Coral Draw
17. Making sample drawing for outdoor and indoor gardens.

Practical

1. Practices in drawing- Measurements, scale and Dimension concepts.
2. Different types of drawings-2D , 3D, plan view, Isometric, perspective etc
3. Base plan reading-Bubble diagrams, Location identification.
4. Legends in diagram
5. Drafting surface and measurement conversion
6. Introduction to AutoCAD –its advantages and uses
7. AutoCAD-toolbars and icons- blocks-drafting objects-Lines, Arc, Eclipse, etc., Array, polylines, attributes
8. File handling functions- modifying tools modifying comments.
9. Creation of garden components -detailing and visualization tools.
10. Photoshop package for 3D picture insertion.

11. Practicing various software's like ARCHICAD, Sketch up.
12. Practicing with Sketch up
13. Practicing with Revit, Lands Design.
14. Practicing with landscape Maya, Lumion,
15. Practicing with Garden Planner, Dream Plan.
16. Practicing with Real time Landscape Pro.
17. Practicing with 3D land.
18. Practicing with Terragen, Edificius LAND, Marshalls Garden visualize etc.
19. Practicing with Mobile apps - iScape, Pro Landscape companion.
20. Designing for Public parks and theme parks.
21. Designing for ecotourism spots
22. Designing for Community living and residential garden.
23. Designing for institutional garden.
24. Designing for Institutional garden
25. Designing for Industrial gardens
26. Designing for OAT
27. Designing for water components-fountains, ponds, stream etc
28. Designing for special types of garden
29. 3D rendering and visualization tools
30. Designing visual tour through 3D redndering
31. Inserting pictures using photoshop and coral draw
32. Calculating costs and Budgeting with 2D diagrams
33. 360 Virtual tour to various gardens of India.
34. **Practical examination**

Course outcome

CO 1- The students will be able to understand the basics computer aided drawing for outdoor and indoor spacing.
CO 2 - The student will be able to understand the various AutoCAD drawing tools in landscape designing.
CO 3- The student will be able to design a garden plan with Computer Aided Designing tools.
CO 4- The student will gain skill in working with various software's used in landscape designing.
CO 5 - The student will be able to understand 3D rendering and visualization and plan preparation for a landscape projects

CO - PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	-	-	2	3	3
CO 2	-	-	2	3	3
CO 3	-	-	2	3	3
CO 4	-	-	2	3	3
CO 5	-	-	2	3	3

References

1. Christine Wein-Ping Yu, 1987. Computer-aided Design: Application to Conceptual Thinking in Landscaping.Agrobios Publishing company, Jodhpur.
2. David Byrnes. 2010. Auto CAD 2010 for DUMMIES. Wiley Publishing Inc., UK.
3. Donnie Gladfelter. 2016. Auto CAD 2016 and Auto CAD LT .2016. Autodesk Official Press, Wiley India.
4. Farin Gerald, E., Josef Hoschek. and Myung-Soo Kim. 2002. Handbook of computer aided geometric design. Elsevier, Amsterdam.
5. Misra RL and Misra S. 2012. Landscape Gardening. Westville Publ. House, New Delhi, India.

Suggested websites

1. http://floraculture international.com
2. http://www.wvu.edu/~agexten/hortcult/greenhou/
3. http://www.umass.edu/umext/floriculture/fact_sheets/greenhouse_management.html.
4. https://sharepoint.agriculture.purdue.edu/agriculture/flowers/GHguides.aspx
5. https://www.onlineturf.co.uk/info/turf-ebook
6. http://www.ag.auburn.edu/hort/landscape/structures.html

FLA 512 SEED PRODUCTION IN FLOWER CROPS (1+1)

Learning objectives

- To impart basic knowledge about the importance of seed production in important flower crops.
- To introduce the basic principles of quality seed production in flower crops
- To educate the students about different methods of seed production
- To learn about seed certification and standards
- To provide knowledge on marketing of flower seeds

Theory

Unit I: Scenario of Seed Industry

Scope, scenario and importance of seed production in flower crops. Constraints in flower seed production. Marketing and economics of flower seeds.

Unit II: Seed production-Methods

Methods of seed production, agrotechniques for production of nucleus, breeder and certified seeds. Harvesting, seed processing, seed priming, seed chain, packaging and storage.

Unit III: Population improvement

Mass selection, progeny selection.Use of incompatibility and male sterility, maintenance of variety and seed production in flower crops.

Unit IV: F1 hybrids

F1 hybrid seed production advantages, steps involved in hybrid seed production, pollination behaviour and isolation, pollination management methods in production of F1/ hybrids in different flower crops.

Unit V: Seed certification and standards

Seed certification, Seed standards, seed act, plant breeders rights and farmers' rights, Bio safety, handling of transgenic seed crops, importing of seeds and OGL, trade barriers in seed business, sanitary and phytosanitaty issues, custom clearance and quarantine.

Crops: Marigold, petunia, antirrhinum, zinnia, pansy, lupin, calendula, phlox, vinca, dianthus, sunflower, annual chrysanthemum, poppy, corn flower, rice flower.

Practical

Seed production of open pollinated varieties - Seed production of cross pollinated varieties - Steps involved in hybrid seed production - Hybrid seed production in different flower crops like marigold, petunia, antirrhinum, zinnia, pansy, lupin, calendula, phlox, vinca, dianthus, sunflower, annual chrysanthemum, etc. - Visit to seed industry - Visit to quarantine facility

Lesson plan

1. Scope, scenario and importance of seed production in flower crops
2. Constraints in flower seed production
3. Marketing and economics of flower seeds
4. Methods of seed production, agrotechniques for production of nucleus, breeder and certified seeds
5. Harvesting, seed processing, seed priming
6. Seed chain, packaging and storage
7. Seed certification, Seed standards, seed act, plant breeders rights and farmers' rights,
8. Bio safety, handling of transgenic seed crops, importing of seeds and OGL
9. **Mid semester examination**
10. Trade barriers in seed business, sanitary and phytosanitaty issues, custom clearance and quarantine.
11. F1 hybrid seed production advantages
12. Steps involved in hybrid seed production, pollination behaviour and isolation,
13. Pollination management methods in production of F1/ hybrids in different flower crops
14. Mass selection
15. Progeny selection
16. Use of incompatibility and male sterility in seed production
17. Maintenance of variety and seed production in flower crops.

Practical

1. Seed production of open pollinated varieties
2. Seed production of open pollinated varieties
3. Seed production of cross-pollinated varieties
4. Seed production of cross-pollinated varieties
5. Steps involved in hybrid seed production
6. Steps involved in hybrid seed production
7. Hybrid seed production in marigold, petunia,

8. Hybrid seed production in antirrhinum, zinnia,
9. Hybrid seed production in pansy, lupin,
10. Hybrid seed production in calendula, phlox,
11. Hybrid seed production in vinca, dianthus,
12. Hybrid seed production in sunflower, annual chrysanthemum, etc.
13. Visit to seed industry
14. Visit to seed industry
15. Visit to seed industry
16. Visit to quarantine facility
17. **Final practical examination**

Course outcome

After successful completion of this course,
CO 1-To really understand the basic principles of seed production in varieties and hybrids
CO 2-To know the concept of and methods of hybrid seed production
CO 3-To understand the importance of field standards and seed standards in quality seed production
CO 4- Students will get awareness on seed standards, certification and law in flower crops.
CO 5- To calculate the economics of flower seed production

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	3	3	2	1	-
CO 2	3	3	2	1	-
CO 3	-	-	2	2	3
CO 4	3	3	2	1	-
CO 5	3	3	2	1	-

References

1. Bhattacharjee SK. 2018. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
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4. Larson RA and Armitage AM. 1992. Introduction of Floriculture. International Book Distributing Co., Lucknow, India.