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UNIVERSITY OF MYSORE

Estd.1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC at 'A')

(NIRF-2022 Ranked 33 in University Category & 54 in Overall Category)

No.: PMEB-1/Spl./28(3)/2021-22 **Date: 17-04-2023**

NOTIFICATION

Sub.: Syllabus and Examination pattern of **M.Sc. (Agri.) Agronomy, M.Sc. (Agri.) Genetics and Plant Breeding** and **M.Sc. (Agri.) Entomology** courses under Specialized Programmes from the academic year 2023-24-reg.

Ref.: 1. Decision of the BOS Meeting held on 22-02-2023.
2. Decision of the Faculty of Science & Technology meeting held on 15-03-2023.
3. Decision of the Academic Council meeting held on 24-03-2023.

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The Board of Studies in **M.Sc. (Agri.) Agronomy, M.Sc. (Agri.) Genetics and Plant Breeding and M.Sc. (Agri.) Entomology (PG)** at its meeting held on 22-02-2023 has recommended to approve the scheme of examination and the syllabus of **M.Sc. (Agri.) Agronomy, M.Sc. (Agri.) Genetics and Plant Breeding** and **M.Sc. (Agri.) Entomology** courses in University of Mysore under specialized/specified programs as per CBCS Scheme from the academic year 2023-24.

The Faculty of Science & Technology and the Academic Council at their meetings held on 15-03-2023 and 24-03-2023 respectively, have also approved the above proposal and the same is hereby notified.

The syllabus of **M.Sc. (Agri.) Agronomy, M.Sc. (Agri.) Genetics and Plant Breeding and M.Sc. (Agri.) Entomology** courses may be downloaded from the University website **https://uni-mysore.ac.in/PMEB/**.

REGISTRAR

REGISTRAR
University of Mysore
MYSURU - 570 005

To;

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DoS in Earth Science, Manasagangothri, Mysuru.
3. Prof. B. Sannappa, DoS in Sericulture Science, Manasagangothri, Mysuru.
4. The Principal, Sampoorna International Institute of Agri. Science & Horticulture Technology, 271/2, KB Doddi Grama, Madapura Doddi, Nidagatta Post, Maddur Tq., Mandya Dist.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
7. Office Copy.

UNIVERSITY OF MYSORE

Crawford Hall, Vishwavidyanilaya Karya Soudha,
Mysuru, Karnataka - 570005

POST GRADUATE REGULATION & SYLLABUS
Specialized Progammes

FOR

M. Sc. (Agri.) in Agronomy

Offered at

Sampoorna International Institute of Agri. Sciences and Horticultural Technology

271/2, K.B. Doddi, Gram, Madapuri Doddi, Nidagatta Post, Maddur (tq), Mandya (Dist.)

2023-2024

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POST GRADUATE REGULATIONS 2023-2024

1. TITLE

The Academic Information and Regulations shall be called "University of Mysore Academic Information and Regulations governing **Post graduate Degree Programmes in Agriculture Subjects under Semester System of Specialised Programme**" to be offered by the Sampoorna International Institute of Agri. Science and Horticultural Technology in addition to the Academic Regulation of the University of Mysore. These shall be applicable for students admitted from the Academic year 2023-24 and onwards.

2. DEFINITIONS

2.1 Academic Year: An academic year is a period during which a cycle of study is completed. It shall consist of two Semesters. Dates of registration, commencement of Instructions, semester end examination and academic calendar shall be approved by the University of Mysore

2.2 Semester: A Semester shall consist of not less than 110 instructional days. The final examinations shall be completed in then extten working days.

2.3 Curriculum: A series of courses designed to provide learning opportunities to meet there quirements for a degree as per BSMA (Broad Subject Matter Area) norms of the Indian Council of Agriculture Research. Courses with 500 series are applicable for master's degree Programmes.

2.4 Course: A course is a unit of instruction or segment of subject matter as specified in course calendar to be covered in a semester. It has a specified number, title and credit hours.

2.5 Credit Hours (Course Credit): A measure of quantity of work done in a course. One credit represents one hour of lecture or 2 hours of laboratory or fieldwork per week through a semester.

2.6 Course Load: The number of credit hours a student can register in a semester. A student shall not register for more than 23 credits in a semester.

2.7 Grade Point of a Course: A measure of quality of work done in a course to meet the requirement in a semester. It is computed by dividing the percentage of marks obtained in a course by 10. It shall be expressed on a 10-point scale up to third decimal place. A grade point of 6.00 and above shall be considered as successful completion of the course.

2.8 Grade Point Average (GPA): It is a quotient of the total course credit points secured by a student in various courses registered divided by the course credits during that semester. It shall be corrected to the third decimal place.

2.9 Cumulative Grade Point Average (CGPA): It is the cumulative performance of a student in all the courses taken during all the preceding semesters. CGPA is computed by dividing the total credit points earned by a student in all the courses taken from the beginning of the first semester by the total number of credits completed up to the end of a specified semester. It shall be corrected to the third decimal place.

2.10 Overall Grade Point Average (OGPA): It is a measure of the overall performance of a student on completion of the degree programme. It is computed by dividing the total number of course credit points earned by a student over the semesters by the total number of credit hours and corrected to the third decimal place. A minimum of 7.00 OGPA is necessary for a pass for master's degree.

3. POST GRADUATE DEGREE PROGRAMMES

The following degree programmes are offered at the **Sampoorna International Institute of Agri. Science and Horticultural Technology**, under the aegis of the University of Mysore, Mysuru. The Post graduate programmes leading to MASTER'S DEGREE **M.Sc. (Agri.) in Agronomy.**

4. MODE OF ADMISSION

Application for admissions will be notified by the Institution every year. Eligible and desiring students can apply in the prescribed form along with the copies of the necessary documents either online or offline as notified by the Institution from time to time. All post graduate students admitted tentatively after paying the prescribed fee notified by the institution and submission of the original documents to the Institution have to further register with the University of Mysore as per the norms by paying the prescribed fee. However, the admission will be valid only after the University of Mysore approves the candidacy of the students.

4.1 Criteria for admission

Indian Nationals with a four-year Basic degree in Agriculture, Horticulture, Sericulture, Forestry and /or related /allied Sciences with an Overall Grade Point Average of 6.00 (60 % Marks)in the basic degree are eligible to get the admission. The medium of instruction shall be in English. Criteria for admission shall be notified from time to time.

4.1.1 Indian Nationals with foreign degree, children of NRIs/Foreign Nationals with a similar or equivalent degree are also eligible to apply to the Institution for admission but are to be approved by the University of Mysore. On selection, they have to pay the prescribed fee of the Institution and submit

the original documents as required by the institution/University of Mysore notified from time to time.

Admission for the seats which are not reserved, shall be made strictly according to the merit as well as first come first serve basis as the course is self-financed. However, the allotment of the seat shall be determined as outlined below:

4.1.2 The admission of candidates is subject to the following conditions:

a) Seats being vacant.
b) Verification of original marks cards and other details furnished in the application.
c) Payment of prescribed fee to the SIIASHT be made on or before the notified date by the authorities of SIIASHT and the University of Mysore to that particular academic year, failing which the admission is liable to be cancelled and any amount paid is non-refundable.
d) Production of medical fitness certificate at the time of registration.
e) Submission of duly signed **Annexure – V (i)** Rules and Regulations, **Annexure V (ii)** & **V (iii)** Undertaking / Declaration, **Annexure – V (iv)** and **Annexure – V (v)**. Acceptance letter of Admission and **Annexure VI (i)** to **Annexure – VI (iv)**. Application form, Rules and Regulations with Undertaking of the Hostel for the hostelites of the SIIASHT are mandatory to be submitted by both the students and a responsible guardian or parent of the student.

5. RESIDENTIAL REQUIREMENTS

A minimum of TWO Academic years (FOUR semesters) shall ordinarily be required for the programme of course work, research, thesis preparation and examinations leading to the Master's Degree. However, the duration may be extended up to a maximum of EIGHT semesters. The institution has no provision to accommodate part time studentship.

5.1 During the entire degree programme, a student enrolled is expected to be a full-time student. As a consequence, he/she is not permitted to work during the two-year period of enrolment, except in research and teaching related works within the premises of the Institution.

5.2 All enrolled PG students shall, therefore, give the following undertaking at the time of registration for every semester till they complete their residential requirements:

I, ..., ID No .. …….. studying Master's degree in ……., hereby give the undertaking that I will be a fulltime student and will not work anywhere during the I/II Semester of the academic year ……..., failing which my admission be cancelled.

Date: Signature of the Student

(Forwarded by the Chairperson and PG Coordinator to the Dean)

5.3 Despite the above undertaking, if any PG student is found working outside the Institution during the period of registered semester, action will be taken to consider the specific semester as null and void. Therefore, the student may have to repeat the specific work registered for the semester.

6. TIME LIMIT FOR COMPLETION OF THE DEGREE

A candidate admitted to the Masters' degree programme may be declared qualified for the degree, provided the candidate completes all the prescribed requirements within EIGHT consecutive semesters from the date of admission irrespective of his / her registration, failing which the admission shall be deemed to have been cancelled.

7. MIGRATION CERTIFICATE

Candidates from other Universities should produce Migration Certificate within the completion of the first semester, failing which their admission will be cancelled.

8. REGISTRATION FOR THE FIRST SEMESTER

Candidates on receipt of admission notice from the Institution shall submit the original documents, pay the prescribed fee notified from time to time and register for the relevant courses in person on or before the last date specified, failing which they shall for feit their admission.

8.1 For those students who were admitted subsequently, attendance shall be counted from the date of their registration.

8.2 A student who registers for the first semester of the Academic Degree Programme should complete a minimum of SIX credit hours securing a grade point other than 'F'or'SA'(Shortage of Attendance) failing which his/her admission shall stand cancelled. This will not be applicable to re-admitted candidates.

8.3 However, in genuine cases of hospitalisation resulting in immobilisation, a student

can be exempted from the above clause provided sufficient proof is produced. The genuineness of such cases shall be examined and considered by a committee consisting of Dean of the Institution, Coordinator of PG studies and a Senior Professor in the Department/Institution.

9. REGISTRATION FOR THE SECOND AND SUBSEQUENT SEMESTERS

9.1 Registration for second and subsequent semesters shall commence TWO weeks prior to the closure of the ongoing semester.

9.1.1 The students registering for the courses shall do so in person/notified mode and by producing the ID card for verification at the time of Registration. Only under unavoidable circumstances, a student may be permitted by the Dean of the Institution to register in absentia.

The last date for registration without penal fee shall be the FIRST day of the semester.

9.1.2 However, students are permitted to register up to SIX working days after the last date, on payment of prescribed penal fee notified from time to time for late registration. After the SIXTH working day, the Dean of the Institution may permit the student to register with in next SIX working days on genuine grounds and on payment of additional late fee notified from time to time.

9.1.3 The attendance shall be counted from the date of commencement of the semester, irrespective of the date of registration. In case of newly admitted students, attendance shall be calculated from the date of registration.

9.1.4 Any student failing to register for subsequent semester within the prescribed time shall be deemed to have discontinued during that semester. However, student shall provide necessary documentary evidence to the Dean along with representation for discontinuation and by producing NO-DUES CERTIFICATE from the Hostel, Library, Accounts section, Sports section, Stores Section and the Respective Department.

9.1.5 Students shall clear all the dues to the Hostel(s), Library, Accounts section, Sports section, Stores Section and the Respective Departments be for eregistration of every semester.

A student may be permitted to add an approved course after the registration, provided the total number of credits is within the prescribed limit.

9.1.6 Adding of the courses should be done with the written permission of the

PG Coordinator within **15** working days from the date of commencement of the semester.

9.1.7 A student will be permitted to drop a course upto a period of FOUR weeks from the date of commencement of the semester on the recommendation of the PG Coordinator and the permission of the Dean of the Institution.

9.1.8 Master's. students submitting thesis after completion of FOUR semesters, shall register specifically for thesis submission by paying the prescribed fee as notified from time to time.

9.2 RE-REGISTRATION

A student who discontinues for a semester with prior permission of the institution/University can re-register during any subsequent semester not exceeding the limit of EIGHT semesters from the date of admission by paying the prescribed re-registration fee as notified from time to time along with other fees within the prescribed time limit

9.3 RE-ADMISSION

The students who fail to complete their degree programme within the prescribed maximum of EIGHT semesters will not be eligible to get their degree. However, such students can seek re-admission with the approval of the University of Mysore to the same degree programme, by following the normal admission procedure by paying the requisite fee of the Institution/University of Mysore as notified from time to time. Such students will get the benefit of transfer of credits and will be able to complete their pending requirements to get the degree.

9.4 TRANSFER OF CREDITS INRESPECT OF MASTER'S DEGREE STUDENTS.

If a Master's degree student, after getting admission in a particular discipline has successfully completed the supporting and common courses and subsequently joins for Master's degree in a different discipline, is eligible to get the transfer of credits of the supporting and common courses, with grade to which the student gets fresh admission provided the student has completed the course with grade point average of 7.00 and above out of 10.00. However the duration of the master's degree would be counted starting from the date of admission to the new degree programme. Further, "Transfer of Credits" earned from previous admission shall be mentioned in the transcript.

10. FEE

A student who enrolls for Post Graduate programme shall be required to pay the prescribed fee that would be notified from time to time by the Institution and the University of Mysore and announced at the beginning of each academic year.

TUITION AND OTHER FEE ONCE PAID WILL NOT BE REFUNDED.

10.1 Fee for second and subsequent semesters shall be as prescribed by the Institution and the University of Mysore time to time.

10.2 Caution money is refundable on successful completion of the degree programme for which a candidate is admitted or if admission is cancelled. The students can claim the caution money after furnishing the "No dues" certificate from all the concerned within SIX months after completion of the degree programme or cancellation of the admission.

10.3 Miscellaneous and other Fee for University enrolment, certificates, re-registration, convocation, thesis submission *etc*., shall be paid as prescribed by the Institution/University from time to time and is not liable to be refunded.

11. CREDIT REQUIREMENT FOR MASTER'S PROGRAMME

As a National Agenda, Indian Council of Agriculture Research, New Delhi, in its wisdom has developed very detailed structure of course work for Master's degree programmes in various disciplines related to Agriculture. At the SIIASHT, Master's programmes are therefore, designed to be fully in tune with the National Agenda. The details of course and credit requirements for the Master's programmes at the SIIASHT are as follows.

Table 11.1 DISTRIBUTION OF COURSE CREDIT

REQUIREMENTS FOR MASTER'S PROGRAMMES:

Sl. No.	Course Type	No. of Credits
1	Major Courses	20
2	Minor Courses	08
3	Supporting Courses	06
4	Common Courses	05
5	Seminar	02
6	Qualifying Examination	02
7	Research	27
	Total	**70**

11.1 MAJOR COURSE :

Major courses are the courses of the respective Departments in which a master's Student is enrolled. These are considered as Core and Compulsory courses as decided by the Department. A minimum of 20 credits of Major courses should be completed by the student to be eligible to acquire the Degree.

11.2 MINOR COURSES:

Minor course is from the subject closely related to a Major Subject and a student shall be permitted to register only ONE course from the parent discipline to meet the credit requirement of Minor Courses. Rest of the credit requirement can be chosen from other disciplines or the listed supporting courses.

11.3 SUPPORTING COURSES:

Supporting courses are not related to the major subjects. It could be any subject considered relevant for student's research work are necessary for building his/her overall competence.

Table 11.2 THE FOLLOWING COURSES MAY BE OPTED UNDER THE SUPPORTING COURSES

Code	Course title	Credits
AST 501	Mathematics for applied sciences	2+0
AST 502	Statistical methods for applied sciences	3+1
AST 511	Experimental designs	2+1
AST 512	Basic sampling techniques	2+1
AST 521	Applied regression analysis	2+1
AST 522	Data analysis using statistical packages	2+1
MCA 501	Computers fundamentals and programming	2+1
MCA 502	Computer organization and architecture	2+0
MCA 511	Introduction to communication technologies, computer networking and internet	1+1
MCA 512	Information technology in agriculture	2+0
BCM 501	Basic biochemistry	3+1
BCM 505	Techniques in biochemistry	2+2

11.4. Common Courses :

The following courses of one credit each will be offered to all the students undergoing master's degree programme which can be combination of online and offline as identified by the institution.

Table: 11.3 Common courses for Master's Degree progamme

Sl. No.	Course Code	Course Title	Credit Hours
1	CMC501	Library And Information Services	0+1
2	CMC502	Technical Writing and communication skills	0+1
3	CMC503	Intellectual Property and its Management in Agriculture	1+0
4	CMC504	Basic Concepts in Laboratory Techniques	0+1
5	CMC505	Agricultural Research, Ethics and Rural Development Programmes	1+0

11.5 ADDITIONAL COURSES

Based on the specific requirement related to the research topic of a student, the Advisory committee can recommend ONE or TWO additional courses. The additional courses can be of any department being offered at the SIIASHT. Course load of not exceeding THREE credit hours is permitted to be registered under additional courses that are approved by the advisory committee. However, these courses are considered as non-load courses and are not counted for calculation of CGPA/OGPA, but he/she has to undergo regular evaluation process.

12. PERMISSIBLE WORK LOAD

A Master's postgraduate student may register up to a maximum of **23** credit hours in a semester (excluding non-credit courses) on the recommendation of the Major Advisor / PG Coordinator.

Seminars can only be registered during the SECOND year with a maximum of ONE credit per semester.

12.1 DISTRIBUTION OF COURSES BY SEMESTER

At the SIIASHT, Schedule of course loads for all the FOUR semesters of a master's degree programme will be decided by the respective department /institution.

13. ATTENDANCE

The students are required to attend a minimum of **80** percent of the total number of lectures and practicals in each course. If a student falls short of the required attendance to an extent of TEN percent or less in any given course, the shortage may be condoned by the Dean on the recommendation of the course teacher and the PG Coordinator, on the condition that the shortage was due to unavoidable circumstances. Further, such a condonement of the attendance entails penal fee for each course separately to be paid by the student notified from time to time.

Attendance should be credited to the students who represent the University/ College in sports/cultural/literary events, etc., on recommendation of the PG Coordinator with the approval of the Dean, by providing documentary evidence.

13.1 The grade point of a student who does not meet the attendance requirement in a course (including Seminar and Research) shall be indicated as "SA" (SA-Shortage of Attendance). Such students have to re-register and complete the concerned course in subsequent semester AS AND WHEN IT IS OFFERED.

13.2 All Post graduate students enrolled are expected to sign every working day of the Institution in the prescribed Departmental Attendance Register. Those students who have registered for research and conducting their research in an institution or organization other than SIIASHT shall submit a document of attendance on monthly basis from the Major Advisor or Co-Advisor so designated of the respective Orgnisation/Institution.

14. ADVISORY COMMITTEE

An advisory committee will be constituted for every PG student with Major Advisor as the Chairperson, who is a recognized PG teacher in the concerned discipline.

A Major Advisor can be from the Sampoorna International Institute of Agri. Science and Horticultural Technology or from any other institution or Organisation affiliated to the University of Mysore or other State or National level Educational/Research Institution or an Organisation concerned to Agriculture and allied fields.

14.1 If a Major Advisor is from an institution other than the SIIASHT, then a Co-Advisor is appointed from the SIIASHT, who would take the responsibility of the student research and other academic activities at the Institution level.

Alternatively, Major Advisor can be from the SIIASHT and a Co-Advisor can be from the Institution /organization where the student would be permitted to conduct the research.

14.2 The Advisory Committee of a Master's degree student shall consist of three members among whom two members including the Chairperson are from major discipline and one from the supporting discipline.If the Major Advisor is not from the SIIASHT, then the committee would be of four members including the Co-Advisor.

Further, if the Major Advisor feels the need for an additional member, it can be permitted limiting the number of the committee to four members.

14.3 The PG Coordinator shall submit the proposal for the constitution of Advisory Committee (Form–1) of the student to the Dean of the institution for approval. This

shall be completed before the closure of the first semester.

14.4 The Major Advisor shall submit the Plan of Work and Programme of Research (Form-2) as approved by the advisory committee to the Dean through PG Coordinator for approval before the end of the second semester.

All the members shall compulsorily attend the Advisory Committee meetings. However, under unavoidable circumstances one of the members other than the Chairperson may be absent.

15. QUALIFICATION OF THE MAJOR ADVISOR

A faculty member, with a Ph.D. in the concerned subject or with an M.Sc. (Agri.) degree and FOUR years of Teaching/ Research/ and /or Extension is eligible to serve as Major Advisor.

Similarly, any member of the faculty of respective department can serve as the member of the Advisory Committee.

15.1 EXAMINATION AND EVALUATION

Teachers shall be responsible for judging and grading the students' performance in each of the courses registered by the student through a system of examination.

15.1.1 The performance of the student in a course shall be graded on a ten-point scale up to three decimal points.

15.1.2 A student obtaining a grade point of lessthan 6.00 shall be declared as 'Failed' (F) in that course. A student who obtains 'F' or 'SA' grade in courses shall repeat that course when it is offered again by paying prescribed fee for re-registration as notified by the institution from time to time.

15.1.3 In the event of a student getting an 'F' or 'SA' grade in a particular non-core course (non-Major), he may be permitted by the Dean of the Institution on the advice of the Advisory Committee to register for an alternative course to facilitate the student's chances of timely completion of the degree programme. However, such alternative courses may be limited to a maximum of two non-major courses during the entire degree programme.

For computing the GPA and CGPA, "F" or "SA" grades shall be considered as zero.

In each course, total marks shall be a maximum of 100 marks for the purpose of grading.

Table: 15.1 Shows the actual maximum marks for the conduct of the examinations would be as indicated below.

Particulars	Courses with Theory and Practical Component Marks	Courses with only Theory Component Marks	Courses with only Practical Component Marks
I Examination (C1)	15	15	15
II Examination (C2)	15	15	15
Final Examination(C3)	70	70	70
Practical Examination, Practical Records, Assignments, *etc.*(C3)	70		-
Total	**170**	**100**	**100**

15.1.4 Both C1 and C2 Components are Internal Examinations that will be conducted by the course teacher and monitored by the PG Coordinator. The Final Theory Component (C3) would be an External Examination to be conducted by the University of Mysore and strictly monitored by the University of Mysore, Mysuru. Practical examination would be conducted by the course teacher with an external examiner nominated by the PG Coordinator within the Institution and the examination would be monitored by the PG Coordinator.

15.2 Question paper pattern

The pattern of Final written examination will be as indicated below:
Part A – Each paper consists of 20 MCQs of one mark each
Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions

15.3 Evaluation of Internals

15.3.1 Courses with both Theory and Practical Components:

This will be based on test, assignment, presentation. The first component of C1 conducted during 1st half of the semester, the first 50% of the syllabus (Unit 1 & unit 2) will be completed and the second component C2 during second half of the semester the remaining units (unit 3 & unit 4) of the syllabus will be completed, both C1 and C2 will have the both L + P courses.

15.3.1.1 The distribution of marks for both component C1 & C2 are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (2)

C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)

C2 = (3) + (4)

15.3.1.2 Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

15.3.1.3 Practical Examination will be for 70 marks that is split as follows:
Actual Practical Examination that includes written component: 50.00 marks
Practical Record: 10.00 and
Assignment/Viva: 10.00

15.3.1.4 The Final External theory exam and the practical exam marks is computed as follows
Let L = no. of credit hours for theory
P = no. of credits hours for practical
If X is the marks obtained by a student in theory exam and
Y is the marks obtained by the same student in practical examination, then the marks computed, M would be
$M = (L * X + P * Y)/ (L + P)$

Example for calculation of GPA for a student with both theory and Practical components.
Let L= 2 credits and X = 55
P = 1 credit and Y = 65
Then, M = ((2 * 55) + (1 * 65)) / (2 + 1) = (110 + 65)/3= 175/3 = 58.33 that would be rounded of to 58.00 marks.
If the student, in addition, has secured 7 and 9 marks in C1 and C2 respectively, then the total marks would be = 58.00 + 7.00 + 9.00 = 74.00

Therefore, the student will have a GPA of 7.4 for the specific course.

15.3.2 Courses with both only Theory Component P=0:

The distribution of marks for both component C1 & C2 in courses with only theory are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ----(2)
C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)
C2 = (3) + (4)
Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

The total adds up to 100.00 marks.

15.3.3 Courses with both only Practical Component L=0:

The distribution of marks for both component C1 & C2 in courses with only practical are as follows:

Conduct of an experiment or written exam:10.00 ------- (1)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(2)
C1 = (1) + (2)

Conduct of an experiment or written exam:10.00 ------- (3)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(4)
C2 = (3) + (4)

Final Component assessment C3 examination that may include written component also: 50.00 marks.

Practical Record: 10.00 and
Assignment/Viva: 10.00
The total adds up to 100.00 marks.

15.4 The schedule of examinations in each course shall be notified by the respective PG Coordinator for the internal examinations. The schedule for the Final theory examinations will be by the University of Mysore. The first Component in each course will be conducted between 7^{th} and 8^{th} week and the second examination between 13^{th} and 14^{th} week. Practical examinations will be conducted during the last week of instructional days. The final theory examination will be conducted after 110 instructional days but with in the next 10 working days.

15.5 The student shall complete all the approved courses with an Overall Grade Point Average (OGPA) of not less than 7.00 out of 10.00 to be eligible for the award of the master's degree within the residential period.

15.6 In case a student fails to secure the minimum OGPA, the student will be permitted to repeat those courses in which the student has secured a grade point below 7.00 in Masters' degree, provided he/she registers the course by paying the prescribed fee notified by the institution from time to time. The grade point of the course repeated shall be considered for computing the OGPA.

15.7 Missed examination.

A student representing the College / University in sports / cultural / literary activities etc., will be provided the attendance and examination which the student has missed with the approval of the PG Coordinator and the Dean of the Institution. Such students are exempted from missed examination fees.

15.7.1 Students who miss any internal examination in a course due to hospitalization/death of parent/ own marriage/ attending interview/attending court cases, may be permitted by the PG Coordinator to appear for the missed examination on their commendation of the course teacher by paying the prescribed fee notified by the institution from time to time for each of the missed examination. Further, a student is eligible to appear for only one missed examination in a course in a semester.

15.7.2 The missed examination shall be conducted within 15 days from the date of missing the internal examination. The course teacher shall notify the date of missed examination and the students failing to take the missed examination on the notified date by paying a prescribed notified fees and time will have no further claim for another examination. Whereas the regulations prescribed for missed examination in a course shall not be applicable for final examination of each course

15.7.3 In case of missing an examination on medical grounds, a certificate from a government Medical Practitioner should be produced. Students staying at the campus in the College Hostel should produce the medical certificate issued from the designated Medical Officer.

A student may appeal to the Dean for redressal of grievances relating to the appearance for the missed examination.

The regulations prescribed for missed examination shall not be applicable for comprehensive written qualifying examination conducted by the university of Mysore in Masters' programmes.

16. SUBMISSION OF GRADE REPORTS

16.1 The evaluated answer papers of internal examinations shall be returned to the students only after the finalization of the grades by the University.

16.2 A student should fulfill all the requirements for the completion of course, failing which the grade point will be finalized based on the marks secured.

The PG Coordinator shall evaluate the Attendance percentage of all the students in the different Courses and send the same to the examination section of the University of Mysore after notifying the same to the respective students to determine the eligibility to take the Final Examination in each course. The Attendance Report and internal examination marks should reach the Examination section of the University of Mysore on or within the scheduled date as announced in the University notification.

16.3 A Grade point card of a student will be prepared for each semester based on the marks secured by the student by the University of Mysore and Transmitted to the College for further documentation and onward transmission to the student.

17. QUALIFYING EXAMINATION

17.1 A student is eligible to register for qualifying examination on completion of 75 percent of approved courses including 20 credits of major courses, excluding research and seminar. Separate Registration for qualifying examination should be completed by paying the prescribed fees within eight weeks from the commencement of the semester with the approval from the PG Coordinator.

17.2 The qualifying examination will carry TWO credits and shall consist of two parts:

17.2.1 Written examination for 150 marks covering 20 credits of core courses. 75 marks each for PAPER I and PAPER II Paper patterns:

Part A – Each paper consists of 25 MCQs of one mark each and the question paper shall not be returned.

Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions
Courses for Paper I and Paper II will be notified by the PG Coordinator.
Each paper will be conducted for two and half hours.

17.2.2 *Viva-voce* for 50marks.

The University of Mysore shall conduct the written qualifying examination. Three sets of questions for each course will be developed and submitted by the individual course teachers to the PG Coordinator. Who in turn will develop a set of three papers each for the two examinations to be submitted to the University. The Chairman, BOS will choose one each finally for the two written examinations. Alternatively, the University will nominate an External Examiner for setting the question papers and evaluation of the answer scripts.

17.2.2.1 The *viva-voce* examination shall be conducted by the Advisor Committee with an external examiner designated by the University of Mysore. In a day *viva-voce* examination for a maximum of six students may be scheduled.

17.2.2.2 The external examiners shall be specialists in the major field from outside the Institution. The PG Coordinator will be the Chairperson of the Examination Committee and shall be responsible for communicating the results of the examination to the Dean of the Institution, who in turn will pass on the Results to the University of Mysore.

Not more than one member, other than the Chairperson and the External examiner, could be absent for the qualifying examination.

17.2.2.3 In special and emergency circumstances, when the Chairperson is unable to be present and conduct the qualifying examination, the Dean may designate, a Senior Professor to officiate as Chairperson to conduct the qualifying examination.

17.2.2.4 In special and emergency circumstances when not more than two members of the Advisory Committee are unable to be present and conduct the qualifying examination due to their hospitalization/out of head-quarter on official duty/ on long leave, the Dean may designate one of the faculty members to officiate as a member to conduct the qualifying examination.

17.2.2.5 The minimum requirement for a pass in the qualifying examination shall be a Grade Point of 7.000 (aggregate of written and viva voce examinations) with the stipulation that the student should obtain a minimum of 60 per cent in the written part of the qualifying examination to be eligible for *viva-voce* examination.

17.2.2.6 The qualifying examination will be conducted only once in an academic year. However, as a special case, the students who abstained or failed in the qualifying examination shall re-register for the same in the subsequent semester by paying the prescribed penal fee on the recommendation of the Major Advisor and PG Coordinator with the approval of the University of Mysore.

17.2.2.7 When a master's student has passed the qualifying examination; the student may be admitted to the candidacy of the degree. Formal intimation to this effect would be communicated to the student, Major Advisor and PG Coordinator by the University of Mysore on the basis of the recommendation of the Dean, SIIASHT.

18. SEMINARS AND COLLOQUIA

18.1 A PG teacher in the Institution will be designated as Teacher in charge of seminar course by the PG Coordinator. The student shall submit the topic of the seminar to the seminar teacher for approval. This minor teacher shall notify the topics and the schedule of the seminars within two weeks of the commencement of the semester.

18.2 The post graduate students stationed outside the SIIASHT for Research purpose who are not in a position to attend the seminars in the respective Departments, their participation in the seminars conducted in the respective institutions may be considered for purposes of counting the Attendance, if a regular seminar series exists in the concerned institution/organisation. If not, then the student has to mandatorily attend the seminars in the respective department. These conditions not with standing, the students should attend a minimum of 50 percent of seminars during the Semester in the Department and should give their own seminars in the respective Department. However, overall, 80 % attendance is must for completion of the Seminar course.

18.3 A student shall be permitted to register for seminar from second year of their admission and they will not be permitted to register for more than one seminar in a semester.

Table : 18.1 Evaluation of the seminar shall bed one by the teacher in-charge of the seminar and one additional faculty member as here under:

Sl. No	Description	Marks
1	Synopsis of the Seminar Topic	10.00
2	Presentation including Language, Introduction, Style and Clarity, Sequence and Organization, Topic Coverage	40.00
3	Effective use of Audio-Visual Aids	5.00
4	Time Management	5.00
5	Response to Questions during discussion	10.00
6	Report	30.00
	Total	100.00

In addition to fulfilling the seminar course requirement, each student shall present TWO colloquia related to the research topic first one prior to the submission of Form-2 and the second one after completion of research before circulation of thesis among the members of the advisory committee.

19. RESEARCH

19.1 The credits set aside for Research work for Post graduate Programme is distributed to different semesters. No student shall be permitted to register for Research credits until the approval of Plan of Work and Programme of Research (Form-2).

19.2 If the student does not submit the thesis during the last semester, 'IC' (Incomplete) grade shall be awarded for these research credits. The student shall re-register for these credits within the stipulated period for submission of the thesis.

19.3 Registration for submission of thesis beyond the prescribed period (four semesters for M.Sc.) may be done at any time during the stipulated time of (eight semesters from the date of admission of the student). The research credits registered for the PG degree programmes shall be graded as satisfactory/ not satisfactory after the submission of the progress report to the PG Co-Ordinator through the Major Advisor

20. THESIS SUBMISSION AND FINAL *VIVA-VOCE*

20.1 The student shall submit the thesis as per the guidelines issued by the Institution for **evaluation by the external examiner.**

20.2 Plagiarism

The student who submits the thesis for external has to provide the certificate of plagiarism issued by the University from time to time. The regulations issued through UGC notification on University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations Dtd. 23.07.2018 is applicable to the faculty and students regarding plagiarism. It is mandatory that each thesis submitted be verified for plagiarism and a certificate duly endorsed by the Major Advisor is to be provided by all the master's students.

20.3 The Masters' degree students before the submission of the thesis for external evaluation should compulsorily complete the poster presentation either at the PG Conference of the Institute or at any other scientific conference.

20.4 The thesis submitted in partial fulfilment of the Master's Degree shall be examined by the Advisory Committee and further evaluated by an External Examiner nominated by the Registrar (Evaluation), University of Mysore. The External Examiner shall be appointed by the Registrar (Evaluation) on the recommendation of the Major Advisor through the PG Coordinator, from a panel of three names in India but outside the University.

However, the Registrar (Evaluation) has the discretion of selecting an External Examiner from outside the Panel of specialists suggested. The External Examiner shalls end there port in the prescribed format along with the thesis to the Dean, SIIASHT with a copy of the report to the Registrar (Evaluation).

20.5 If the external examiner does not recommend the thesis for acceptance, the Registrar (Evaluation) may refer the thesis to the second examiner for evaluation on payment of a penal fee. If the second examiner recommends the thesis, the recommendation will be accepted. If the second examiner also does not recommend the thesis, the student shall have to re-write the thesis and re-submit the same after a lapse of one semester, by re-registering for thesis submission. If the thesis of the student is not accepted for the third time also, that thesis cannot be resubmitted. Under such circumstances, the student has to repeat the entire Research credits and work on a different thesis problem.

20.6 The final *viva-voce* examination will be held by the Advisory Committee within one month after the receipt of permission letter from the University to the PG Coordinator. However, under special circumstances the student is allowed to take final *viva-voce* within six months on payment of prescribed penal fee as prescribed by the Institution.

20.7 The Major Advisor shall be the Chairperson of the examination Committee. A designated teacher from within in the Institution will serve as the External Evaluator for the Final Viva-voce examination. External Evaluator for the Final Viva-voce would be appointed by the Dean, SIIASHT, on the recommendations of the PG Coordinator. Under special circumstances when the Chairperson of the Advisory Committee is unable to present and conduct the final *viva-voce*, the Co-Advisor or one of the Advisory Committee Members of the concerned Department can officiate as Chairperson on the recommendation of the PG Coordinator with the approval of the Dean. Further, when more than one member of the Advisory Committee are unable to be present and conduct the final *viva-voce* examination, due to their hospitalization/out of headquarters on official duty / on long leave, the PG Coordinator may designate any PG teacher to officiate on the request of the Major Advisor and HOD, as member to conduct the final *viva-voce*.

20.8 The Chairperson shall send the recommendations of the Advisory Committee to the PG Coordinator. Who in turn will transmit the same to the Registrar (Evaluation) of the University of Mysore, through the Chairman BOS, for the award of the Degree. All the concerned Forms ONE to SIX, will have been completed and submitted by the Institution to the Registrar (Evaluation), University of Mysore by this time, for the student to be eligible to get the Provisional degree Certificate.

20.9 The Thesis copies of the PG student should be type written and bound as specified by the University from time to time. Each student should submit three copies of the thesis and three CDs. Out of three copies of the thesis one each will be submitted to the Library, Department and to the University of Mysore. One CD will be placed in the library, and another will be submitted to the University of Mysore. A CD will also be submitted to the Major Advisor.

20.10 Incase of ICAR/Donor sponsored scholarship holders, a fourth copy of the Thesis along with CD should be submitted to the PG Coordinator for forwarding to ICAR/Donors.

20.11 The Thesis submitted by a student shall constitute the property of the Institution. Whenever an extract from the Thesis is published a foot note shall always have to be given indicating that the Thesis has been submitted for the post-graduate degree of the SIIASHT under the University of Mysore.

Copies of the Thesis deposited in the University Library or in the Departmental Libraries shall not be issued on loan, nor would these be available for reference, for a period of one year from the date of submission.

21. Regulations governing the conduct of Examinations and Prevention of Malpractices among students.

21.1 REGULATIONS GOVERNING THE CONDUCT OF EXAMINATIONS

21.1.1 The scheme of evaluation in each course shall be periodically notified by the University of Mysore.

21.1.2 It is the responsibility of the concerned course teacher to prepare the question paper and safe guard the secrecy.

21.1.3 The course teacher should ensure the prevention of malpractices in examinations. No student should be allowed to enter the examination hall later than 10 min. after the commencement of the exam. No electronic gadget will be allowed inside the examination hall, except when the course teacher permits.

21.1.4 When the teacher notices the student indulging in any malpractice, the teacher shall seize the paper from the student and shall in variably demand a written explanation or statement from the student.

21.1.5 If the student refuses to obey, the fact shall be duly noted and reported in writing to the Dean duly witnessed by another staff member. The teacher shall write remarks on the answer paper and affix the signature and send the candidate out of the hall. Such students shall not be allowed to take further examinations in that course during that semester.

21.1.6 All cases of malpractices should immediately be brought to the notice of the Dean concerned who shall send a report there on to the University authorities for such necessary action as may be deemed fit.

21.1.7 All cases of malpractices referred to the University authorities be examined by a committee set up by the University of Mysore. The decision of the Committee shall be final subject to review by theVice-Chancellor.

The committee may debar the guilty students for a period of one semester.

21.2 REGULATIONS GOVERNING THE PREVENTION OF MALPRACTICES AMONG STUDENTS

21.2.1 The students shall bear in mind that all the examinations under the semester system are University Examinations and should conduct accordingly.

21.2.2 No student shall enter the examination hall with papers, books or notes, electronic gadgets and such other material which might possibly be of assistance.

21.2.3 Any student indulging in malpractices during the examination shall be debarred for a period not less than one semester.

21.2.4. Any candidate found guilty of misconduct of a serious nature in the examination hall shall be debarred for a period of not less than two semesters.

21.2.5 Any candidate found guilty of an offence, shall give a written explanation or statement to the teacher or in-charge of the main examination hall if demanded. If the student refuses to give explanation or statement, student should record in writing for refusal to give such an explanation or statement.

21.2.6 Any candidate, who does not comply with the procedure indicated in the above said rule, may be deemed to have committed an offence shall bear consequent penalty.

21.3 REGULATIONS FOR THE MAINTENANCE OF DISCIPLINE AMONG THE STUDENTS

21.3.1 Every student of the SIIASHT shall conform to the rules of good conduct and respect the authority of the constituted bodies of the Institution and the University.

21.3.2 Every student of the Institution shall have a Student Identification Card with recent photograph affixed and signed by the concerned authority and shall be shown whenever it is demanded.

21.3.3 Students shall do everything possible to protect and make proper use of the Institution property and other public property. Any student who attempts to deface/destroy the Institution or other public property shall be liable for appropriate punishment. In addition, the cost of damage as assessed by the Institution caused by the students shall be recovered from the concerned Student after due examination by the Dean or a designated person by the Dean.

21.3.4 Proper decorum shall be maintained by all the students in the classroom, hostels, library, farms, educational and sports tours, transport vehicles and on & off the Campus of the Institution.

21.3.5 No student shall disturb the normal work of the Institution by disorderly conduct, boisterous behavior and unauthorized assembly.

21.3.6 Ragging in any form in the Institution premises is strictly prohibited. Students found guilty of ragging are liable for disciplinary action.

21.3.7 Every student shall be punctual to the classes. Class Teacher has the right to refuse admission to late-comers in the interest of class discipline.

21.3.8 Absenting to a class or examinations for whatever reason is considered as an act of indiscipline.

21.3.9 No student shall be in a class during the assigned hour unless the student has registered in that course. Students are not permitted to carry mobile phones during the class hours.

21.3.10 Possession or consumption of alcoholic drinks or drunkenness or drug addiction or gambling on the campus is strictly prohibited.

21.3.11 Violation of any one of the above regulations is an act of indiscipline and will be dealt by the Dean/Management or a person appointed by the Dean.

21.3.12 The Dean/Management shall enquire into the act of in discipline of the student(s) and the concerned shall take immediate action such as warning, fine and expulsion from Hostel and suspension from attending the classes for a period not exceeding one semester.

21.3.13 Further, in serious cases, disciplinary proceedings may be instituted through the Disciplinary Committee which can recommend punishment in the form of a warning/expulsion from the college for a semester/year.

21.3.14 Bonafide students will lose all those benefits from the University or from other Institutions with the University approval, if they are found to be involved in any of the acts of indiscipline.

21.3.15 Celebration of festivals on days other than authorized and unruly behaviour on such occasions will be considered as an act of indiscipline.

21.3.16 A student who has been found guilty by the Institution or the Disciplinary Committee and has been fined/suspended/expelled from the College or Hostel, shall not be permitted to hold any office, elected or otherwise, of student associations for a period of two years from the date of completion of the punishment.

21.3.17 If a student is taken into police custody on a criminal or other complaint for a period of 24hours or more, the student shall be deemed to have been suspended from the College for a period of one month from the date on which the student was taken into police custody without instituting an enquiry.

The decision of the Dean under all these Regulations shall be final.

22. CONVOCATION

22.1 The University shall confer degrees to all the students who complete their degree requirements in all respects in an academic year. However, at the time of taking their transcript and provisional degree certificate, they should fill in the convocation application and pay the prescribed fee and exercise their option whether they will be taking the degree in the Annual Convocation IN PERSON or IN ABSENTIA.

22.2 If a student has applied for a particular Convocation to take the degree 'In person' but fails to attend the Convocation, the student has to apply again by paying the penal fee in addition to the prescribed fee.

22.3 In case of death of a student before taking the degree at the Convocation, the nearest relative can apply for getting the degree at the Convocation. In such cases the University may consider confirming the degree on the candidate and award Gold Medals if any, posthumously.

23. REGULATION RELATING TO THE SCHEME OF HONOURING STUDENTS OF OUTSTANDING MERIT

A Gold Medal for each major subject at Master's. level shall be awarded to the students securing the highest Overall Grade Point Average with not less than 9.00 in the concerned Postgraduate degree together with a certificate of Merit. Two or more students getting the same OGPA will be awarded a Medal and a Certificate of Merit each, provided the OGPA is identical even to the fourth decimal. The Gold Medal and a Certificate of Merit shall be awarded at the time of Convocation. The value of each Gold Medal for each candidate will be the same.

The student shall complete all the formalities required for completion of the Degree programme on or before the last working day of the fourth semester from the date of admission of the student to be eligible to get any Medal.

However, the eligible candidate with the highest OGPA than the minimum requirement prescribed for the award of Gold medal will be issued a "Certificate of Merit".

24. DETERMINING CLASS/DISTINCTION

The following OGPA will be considered as equivalent to the Class/Division mentioned.

OGPA 9.00 & above	First Class with Distinction
OGPA 8.00 to 8.99	First Class
OGPA 7.00 to 7.99	Second Class for master's degree

POST GRADUATE FORMS

FORM 1

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B.Doddi, Maddur

Proposal for Constitution / Re-Constitution of Advisory Committee

The following members are proposed for the Constitution/Re-constitution of Advisory Committee in respect of Mr./Ms._____I.D. No._____admitted to Master's Programme in Entomology/Agronomy/Genetics & Plant Breeding during the year _____. The tentative title of his/her research programme is _____ _____ _____ _____ _____

Name and Designation		Address
1.		
2.		
3.		
4.		
5.		

Signature of the Chairperson

Forwarded to the Dean, SIIASHT in duplicate for approval and onward transmission to the University of Mysore, Mysuru..

Date **Signature PG Co-ordinator**

Forwarded to University of Mysore, Mysuru

Note: The form no. 1 should be submitted on or before twelveth week of the first semester

Date **Dean of SIIASHT**

Submitted for Approval and Notification to the **Registrar (Evaluation), University of Mysore**

Signature Chairman (BOS)

FORM 2

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

Plan of work & Programme of Research approved by the Advisory Committee

Date.....

The Advisory committee of Ms. /Mr.....
ID No. ..... admitted to Master's programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding met on ..... at ..... in ..... campus.

(*)1. The plan of work was considered.

2. The programme of research was considered.

3. The plan of work and programme of research were reviewed and the changes suggested are attached herewith.

4. Other issues considered.

Advisory Committee

	Name and Designation	**Signature**
1.	..... (Chairperson)	.....
2.	..... (Member)	.....
3.	..... (Member)	.....
4.	..... (Member)	.....
5.	..... (Member)	.....

Forwarded to the Dean, SIIASHT for information. And documentation and onward transmission to the University ofMysore.

Signature of PG Co- ordinator **Signature**
Major Advisor
Date .....

(*) Please strike off items not relevant

Plan of Work

5. Details of courses to be studied:

I Semester of the year .....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major Courses			Minor courses	
				Supporting Courses	
				Common Courses	
				Additional Courses	
	Total				
				Total	

Total credits.....

II Semester of the year.....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major courses			Minor courses	
				Supporting Courses	
				Common Courses	
	Total			Additional Courses	
				Total	

Total credits.....

6. Total credits proposed for registration:

Sl. No.	Course Type	No. of Credits	
		Min. Required credits hours for Master's Programme	No. of credits hours completed
1	Major Courses	20	
2	Minor Courses	08	
3	Supporting Courses	06	
4	Common Courses	05	
5	Seminar	02	
6	Qualifying Examination	02	
7	Research	27	
	Total	**70**	

7. Tentative title of the research programme:

8. Additional information, if any:

Signature of Student **Signature of Chairperson**

Forwarded to the Dean, SIIASHT for approval.

Date..... **Signature of the PG Co- ordinator**

Programme of Research

1. Title of the research programme /topic:

2. Objectives:

3. Brief review of work:

4. Detailed programme of work:

5. Collaboration with other Departments /Institutions / Organisations and Fellow Scientists:

6. Salient features of the research work:

7. References:

Signature of the Student **Signature of theChairperson**

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean,
SIIASHT,
MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Approved

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 3

Report of the Examining Committee on the performance of the student in Qualifying Examination

Master's. degree programme majoring in ..... met on ..... at the Institute.

The qualifying examination, written as well as oral was conducted by the committee members. He/ She has passed / failed in the Examination.

He/ She has secured ..... marks out of..150 . in written and ..... marks out of .50 in oral examination. The grade point for qualifying examination is ..... out of..10.000.

Member's Present	**Signature**
1. ..... (Chairperson)	.....
2. ..... (Member)	.....
3. ..... (Member)	.....
4. ..... (Member)	.....
5. ..... (Member)	.....
6. ..... (Member)	.....

Members who could not attend

1. .....
2. .....

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 4

Proposal for Nomination of External Examiners for Thesis Evaluation

1. Ms. /Mr. ..... ID No.-..... admitted to M.Sc. (Agri.) degree programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding has completed the course requirements and has passed in the qualifying examination.
2. Her/ his grade point average is .....
3. The title of Her/ his thesis is .....
4. Key words in thesis: .....
5. A panel of names of external examiners, with their addresses, land line and mobile phone numbers and E-mail ID, for evaluation of thesis is furnished here under (3 members for Master's degree programme).

1. .....

2. .....

3. .....

Signature of PG Co-ordinator **Signature of the Chairperson**

Date.....

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for approval.in duplicate for information and needful.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature of Chairman (BOS)

1) Dr. .....is approved.

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 5

Details of Courses and Submission of Thesis

1. Name of the student :
2. I.D. No :
3. Year of Admission :
4. Degree Programme :
5. Major Subject :
6. Thesis entitled : .....
   .....
   .....
7. List of Courses :

Course No.	Title of the Course / Seminar	Credit Hours	Grade Points Obtained
	A. Major courses completed		
	B. Minor courses completed		
	C. Supporting Courses		
	D. Common Courses		
	E. Qualifying Examination		
	F. Seminar completed		
	G. Additional Courses if any		

C. Colloquia presented

Sl. No.	Title of the Colloquium	Date of Presentation
1		
2		

8. Has the Plan of Work and Programme of Research been considered by the Advisory Committee and approved by **Registrar (Evaluation), University of Mysore**
9. Has changes, if any, in the Plan of Work and Programme of Research been recommended by the Advisory Committee and revised approval of **Registrar (Evaluation), University of Mysore** obtained:
10. Furnish details, if the Research topic has been changed.
    Topic of Research: .....
    Revised Topic of Research: .....
11. Has the student completed the total number of credits (Furnish the details).

No. of Credits registered	No. of Credits completed	Semester

12. Has the student submitted her / his thesis within the stipulated period of the PG programme.

Date of Registration for Thesis submission	Date of Submission of Thesis

13. Has the candidacy of the student been declared:

Signature of the Student

.

CERTIFICATE

Certified that the above requirements have been checked with reference to the student file and found correct.

Certified that the student has fulfilled all the requirements of credits for submission of thesis for External Evaluation.

Signature of the PG Co-ordinator **Signature of the Chairperson**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for onward transmission of the thesis submitted for evaluation by the External Evaluator.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

Signature
Chairman (BOS)

Transmitted under intimation to the Dean, SIIASHT,

Registrar (Evaluation)

FORM 6

Report of the Final Viva-Voce Examination

Date .....

The Examining Committee in respect of Ms., ID No. admitted to M.Sc. (Agri.) degree programme during the year and majoring in **Entomology** met on at **the SIIASHT.** .

The committee considered the report(s) of the External Examiner/s and..... on the thesis. The examiner hasrecommended the thesis for acceptance.

The final Viva-Voce examination was conducted by the Committee Members. The performance of the candidate was .....

Signature of the External Examiner

The committee recommends / does not recommend the approval of the thesis entitled **".....".**

Member's Present **Signature**

1. . (Chairperson) .....
2. .....(Member) .....

Members who could not attend

1. .....
2. .....

a) One hard copy and a soft copy of the thesis have been submitted to the Librarian, SIIASHT, Channapattana and a copy of the receipt is attached herewith.
b) One soft copy of the thesis has been submitted to the Major Advisor, SIIASHT, Channapattana.
c) One copy of the thesis submitted herewith to the Chairman, BOS for onward transmission to the University Library
d) The master's student has presented his / her thesis poster on

Date- **Signature of the Chairperson**

Forwarded to the Dean, SIIASHT, Channapattana in duplicate for further needful.

Date- **Signature of the PG Co-ordinator**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for with a request to issue the notification.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

SignatureChairman (BOS)

Notification Issued (To be issued within a week of the receipt of the request)

Registrar (Evaluation)
University of Mysore

Semester wise Distribution of Courses for M.Sc. (Agri.) in Agronomy

I YEAR					
SEMESTER - I					
Sl. No	**Code**	**Course Title**	**Type**	**Credit**	**Total Credits**
1	CMC 501	Library and Information Services	Common	1	
2	CMC 502	Technical Writing and Communications Skills	Common	1	
	CMC 504	Basic Concepts in Laboratory Techniques	Common	1	
Total Credits					**3**
3	AST 502	Statistical methods for applied sciences	Supporting	4	
Total Credits					**4**
4	Agron 501	Modern Concepts in Crop Production	Major	3	
5	Agron 502	Principles and practices of soil fertility and nutrient management	Major	3	
6	Agron 504	Principles and Practices of Water Management	Major	3	
7	Agron 506	Agronomy of major Cereals and Pulses	Major	2	
Total Credits					**11**
8	MCA 512	Information technology in agriculture	Minor	2	
Total Credits					**2**
TOTAL CREDITS FOR I SEMESTER					**20**
SEMESTER - II					
1	CMC 503	Intellectual Property and its management in Agriculture	Common	1	
2	CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	
Total Credits					**2**
3	BCM 501	Basic biochemistry	Supporting	4	
Total Credits					**4**
4	Agron 503	Principles and Practices of Weed Management	Major	3	
5	Agron507	Agronomy of oilseeds, fibre and sugar crops	Major	3	
6	Agron 512	Dryland Farming and Watershed Management	Major	3	
Total Credits					**9**
7	Agron 513	Principles and practices of organic farming	Minor	3	
8	AST 511	Experimental designs	Minor	3	
Total Credits					**6**
TOTAL CREDITS FOR II SEMESTER					**21**

II YEAR					
SEMESTER - III					
1	Agron 581	Qualifying Examination	QE	2	
2	Agron 591	Master's seminar I	Seminar	1	
3	Agron 599	Master's research	Research	13	
TOTAL CREDITS FOR III SEMESTER					**16**
SEMESTER - IV					
1	Agron 592	Master's seminar II	Seminar	1	
2	Agron 599	Master's research	Research	14	
TOTAL FOR IV SEMESTER					**15**

SUMMARY OF CREDITS DISTRIBUTION FOR THE FOUR SEMESTERS

Sl. No.	Course Type	I Semester	II Semester	III Semester	IV Semester	Total No. of Credits
1	**Major Courses**	11	09			**20**
2	**Minor Courses**	02	06			**08**
3	**Supporting Courses**	04	04			**08**
4	**Common Courses**	03	02			**05**
5	**Seminar**	-	-	01	01	**02**
6	**Qualifying Examination**	-	-	02	-	**02**
7	**Research**	-	-	13	14	**27**
	Total	**20**	**21**	**16**	**15**	**72**

COMMON COURSES FOR M. Sc. (AGRI.) IN DIFFERENT DISCIPLINES

To be in tune with the BSMA norms of the ICAR, New Delhi, the following courses (one credit each) will be offered to all students undergoing Master's degree programme at SIIASHT, Maddur

Code	Course Title	Credits	Credit Pattern	Credit Value
CMC 501	Library and Information Services	1	0+1	1
CMC 502	Technical Writing and Communications Skills	1	0+1	1
CMC 503	Intellectual Property and its management in Agriculture	1	1+0	1
CMC 504	Basic Concepts in Laboratory Techniques	1	0+1	1
CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	1	1+0	1

Some of these courses are also available in the form of e-courses. The students are allowed to register for these courses/similar courses on these aspects, if available online on SWAYAM or any other platform with the permission of the PG Coordinator under intimation to the Chairman (BOS) and the Registrar (Evaluation).

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 Major Advisor and the PG Coordinator. However, the overall Credit requirement of a minimum of 05 credits through Common Courses are to be met by every Master's student registered at SIIASHT to meet the norms of the BSMA.

SYLLABUS OF COMMON COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

CMC 501 : LIBRARY AND INFORMATION SERVICES (0+1)

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information-Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Richard E. Rubin. 1998. Foundations of Library and Information Science (Paperback)

Kay Ann Cassell and Uma Hiremath, 2006. Reference and Information Services in the 21st Century : An Introduction.

CMC 502: TECHNICAL WRITING AND COMMUNICATIONS SKILLS (0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical Technical Writing –

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

• Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
• Collins' Cobuild English Dictionary. 1995.
• Harper Collins. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed.
• Holt, Rinehart & Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
• James HS. 1994. Handbook for Technical Writing. NTC Business Books.
• Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East- West Press.
• Mohan K. 2005. Speaking English Effectively. MacMillan India.
• Richard WS. 1969. Technical Writing.
• Barnes & Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
• Abhishek. Sethi J &Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
• Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

CMC 503: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Erbisch FH &Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

CMC 504: BASIC CONCEPTS IN LABORATORY TECHNIQUES (0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
Gabb MH &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

CMC 505: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions;

UNIT II

Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT III

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT IV

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co- operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
- Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
- Singh K.. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

ICAR, New Delhi, as per the norms of the BSMA has suggested the following courses to be offered by various disciplines (The list is only indicative) to meet the requirement of Supporting Courses. It is mandatory that a minimum of Six credits of supporting courses be completed by the Master's degree students in different disciplines. Based on the requirement, some of the following courses have been opted under the supporting courses. The syllabi of these courses are detailed below. At SIIASHT, Maddur, some of these courses are also suggested for Minor courses requirement.

Code	Course Title	Credits	Credit Pattern	Credit Value
AST 501	Mathematics for applied sciences	2	2+0	2
AST 502	Statistical methods for applied sciences	4	3+1	4
AST 511	Experimental designs	3	2+1	3
AST 512	Basic sampling techniques	3	2+1	3
AST 521	Applied regression analysis	3	2+1	3
AST 522	Data analysis using statistical packages	3	2+1	3
MCA 501	Computers fundamentals and programming	3	2+1	3
MCA 502	Computer organization and architecture	2	2+0	2
MCA 511	Introduction to communication technologies, computer networking and internet	2	1+1	2
MCA 512	Information technology in agriculture	2	1+1	2
BCM 501	Basic biochemistry	4	3+1	4
BCM 505	Techniques in biochemistry	4	2+2	4
	TOTAL		**35**	

SYLLABUS OF SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

AST 501: Mathematics for Applied Sciences (2+0)

Aim of the course

This course is meant for students who do not have sufficient background of Mathematics. The students would be exposed to elementary mathematics that would prepare them to study their main courses that involve knowledge of Mathematics. The students would get an exposure to Linear Algebra, differentiation, integration and differential equations etc.

Theory

Unit I

Set theory-set operations, finite and infinite sets, operations of set, function.

Unit II

Vectors and vector spaces, Matrices notations and operations, laws of matrix algebra; transpose and inverse of matrix, Eigen values and Eigen vectors. Determinants -evaluation and properties of determinants, Solutions of Linear Equations.

Unit III

Variables and functions, limits and continuity of specific functions. Differentiation theorems of differentiation, differentiation of logarithmic, trigonometric, exponential and inverse functions, Differentiation of function of a function, derivatives of higher order, partial derivatives. Application of derivatives, determination of points of inflexion, maxima and minima.

Unit IV

Integration, methods of integration, reduction formulae, definite and indefinite integral, Applications of integration in Agriculture, Differential Equations.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Hohn FE. 2013. *Elementary Matrix Algebra*, 3rd Ed., Kindle Edition
• Harville D.A. 1997. *Matrix Algebra from a Statistician's Perspective*. Springer.
• Hohn F.E. 1973. *Elementary Matrix Algebra*. Macmillan.
• Searle S.R. 1982. *Matrix Algebra Useful for Statistics*. John Wiley.
• Stewart J. 2007. *Calculus*. Thompson.
• Thomas G.B. Jr. and Finney R.L. 1996. *Calculus.* 9th Ed. Pearson Edu.

AST 502: Statistical Methods for Applied Sciences (3+1)

Aim of the course

This course is meant for students who do not have sufficient background of Statistical Sciences: Agricultural Statistics Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Theory

Unit I

Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation.

Unit II

Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions.

Unit III

Introduction to theory of estimation and confidence-intervals, Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination, Fitting of quadratic models.

Unit IV

Non-parametric tests – sign, Wilcoxon, Mann-Whitney U-test, Run test for the randomness of a sequence. Median test. Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques, Introduction to Multivariate Analysis, Transformation of Data.

Practical

- Exploratory data analysis, fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal.
- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and Correlation and regression analysis, fitting of Linear and Quadratic Model.
- Non-parametric tests. ANOVA: One way, Two Way, SRS.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Goon A.M, Gupta M.K and Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
- Goon A.M, Gupta M.K. and Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
- Hoel P.G. 1971. *Introduction to Mathematical Statistics*. John Wiley.
- Hogg R.V and Craig T.T. 1978. *Introduction to Mathematical Statistics*. Macmillan.
- Morrison D.F. 1976. *Multivariate Statistical Methods*. McGraw Hill.
- Hogg RV, McKean JW, Craig AT. 2012. *Introduction to Mathematical Statistics* 7th Edition.
- Siegel S, Johan N & Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*. John Wiley.
- Anderson TW. 2009. *An Introduction to Multivariate Statistical Analysis*, 3rd Ed . John Wiley
- http://freestatistics.altervista.org/en/learning.php.
- http://www.statsoft.com/textbook/stathome.html.

AST 511: Experimental Designs (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Agricultural Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

Unit I

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

Unit II

Uniformity trials, size and shape of plots and blocks, Analysis of variance, Completely randomized design, randomized block design and Latin square design.

Unit III

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom. Concept of confounding.

Unit IV

Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined analysis.

Practical

- Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law, Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments,
- Analysis with missing data,
- Split plot and strip plot designs.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG and Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley.
- Dean AM and Voss D. 1999. *Design and Analysis of Experiments*. Springer.
- Montgomery DC. 2012. *Design and Analysis of Experiments*, 8th Ed. John Wiley.
- Federer WT. 1985. *Experimental Designs*. MacMillan.
- Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
- Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*. John Wiley.
- www.drs.icar.gov.in.

AST 512: Basic Sampling Techniques (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

Theory

Unit I

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

Unit II

Simple random sampling with and without replacement, sampling for proportion, determination of sample size, inverse sampling, Stratified sampling.

Unit III

Cluster sampling, Multi-stage sampling, systematic sampling; Introduction to PPS sampling,

Unit IV

Use of auxiliary information at estimation, Ratio product and regression estimators. Double Sampling, sampling and non-sampling errors.

VI. Practical

- Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.;
- Simple random sampling, determination of sample size, inverse sampling, stratified sampling, cluster sampling and systematic sampling;
- Estimation using ratio and regression estimators;
- Estimation using multistage design, double sampling.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG. 1977. *Sampling Techniques*. John Wiley.
- Murthy MN. 1977. *Sampling Theory and Methods*. 2nd Ed. Statistical Publ. Soc., Calcutta.
- Singh D, Singh P and Kumar P. 1982. *Handbook on Sampling Methods*. IASRI Publ.
- Sukhatme PV, Sukhatme BV, Sukhatme S and Asok C. 1984. *Sampling Theory of Surveys with Applications*. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.
- Cochran WG. 2007. *Sampling Techniques*, 3rd Edition. John Wiley & Sons Publication

AST 521: Applied Regression Analysis (2+1)

Aim of the course

This course is meant for students of all disciplines including agricultural and animal sciences. The students would be exposed to the concepts of correlation and regression. Emphasis will be laid on diagnostic measures such as autocorrelation, multi collinearity and heteroscedasticity. This course would prepare students to handle their data for analysis and interpretation.

Theory

Unit I

Introduction to correlation analysis and its measures, Correlation from grouped data, correlation, Rank correlation, Testing of population correlation coefficients; Multiple and partial correlation coefficients and their testing.

Unit II

Problem of correlated errors; Auto correlation; Heteroscedastic models, Durbin Watson Statistics; Removal of auto correlation by transformation; Analysis of collinear data; Detection and correction of multi collinearity, Regression analysis; Method of least squares for curve fitting; Testing of regression coefficients; Multiple and partial regressions.

Unit III

Diagnostic of multiple regression equation; Concept of weighted least squares; regression equation on grouped data; Various methods of selecting the best regression equation.

Unit IV

Concept of nonlinear regression and fitting of quadratic, exponential and power curves; Economic and optimal dose, Orthogonal polynomial.

Practical

- Correlation coefficient, various types of correlation coefficients, partial and multiple, testing of hypotheses;
- Multiple linear regression analysis, partial regression coefficients, testing of hypotheses, residuals and their applications in outlier detection;
- Handling of correlated errors, multi collinearity.
- Fitting of quadratic, exponential and power curves, fitting of orthogonal polynomials.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

VIII. Suggested Reading

- Kleinbaum DG, Kupper LL, Nizam A. 2007. *Applied Regression Analysis and Other Multivariable Methods* (Duxbury Applied) 4th Ed.
- Draper NR and Smith H. 1998. *Applied Regression Analysis*. 3rd Ed. John Wiley.
- Ezekiel M. 1963. *Methods of Correlation and Regression Analysis*. John Wiley.
- Koutsoyiannis A. 1978. *Theory of Econometrics*. MacMillan.
- Kutner MH, Nachtsheim CJ and Neter J. 2004. *Applied Linear Regression Models*. 4th Ed. With Student CD. McGraw Hill.

AST 522: Data Analysis Using Statistical Packages (2+1)

Aim of the course

This course is meant for exposing the students in the usage of various statistical packages for analysis of data. It would provide the students a hands on experience in the analysis of their research data. This course is useful to all disciplines.

Theory

Unit I

Introduction to various statistical packages: Excel, R, SAS, SPSS. Data Preparation; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

Unit II

Test for normality; Testing of hypothesis using chi-square, *t* and *F* statistics and Z-test.

Unit III

Data preparation for ANOVA and ANCOVA, Factorial Experiments, contrast analysis, multiple comparisons, Analyzing crossed and nested classified designs.

Unit IV

Analysis of mixed models; Estimation of variance components; Correlation and regression analysis, Probit, Logit and Tobit Models. Discriminant function; Factor analysis; Principal component analysis; Analysis of time series data, Fitting of non-linear models; Neural networks.

Practical

- Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data;
- Testing the hypothesis for one sample *t*-test, two sample *t*-test, paired *t*-test, test for large samples - Chi-squares test, F test, one-way analysis of variance;
- Designs for Factorial Experiments, fixed effect models, random effect models, mixed effect models, estimation of variance components;
- Linear regression, Multiple regression, Regression plots;
- Discriminant analysis - fitting of discriminant functions, identification of important variables;
- Factor analysis. Principal component analysis - obtaining principal component.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Anderson C.W. and Loynes R.M. 1987. *The Teaching of Practical Statistics*. John Wiley.
• Atkinson A.C. 1985. *Plots Transformations and Regression*. Oxford University Press.
• Chambers J.M., Cleveland W.S., Kleiner B and Tukey P.A. 1983. *Graphical Methods for Data Analysis*. Wadsworth, Belmount, California.
• Chatfield C. 1983. *Statistics for Technology*. 3rd Ed. Chapman & Hall. Chatfield C. 1995. *Problem Solving: A Statistician's Guide*. Chapman & Hall.
• Cleveland W.S. 1985. *The Elements of Graphing Data*. Wadsworth, Belmont, California.
• Ehrenberg ASC. 1982. *A Primer in Data Reduction*. John Wiley.
• Erickson B.H. and Nosanchuk T.A. 1992. *Understanding Data*. 2nd Ed. Open University Press, Milton Keynes.
• Snell E.J. and Simpson HR. 1991. *Applied Statistics: A Handbook of GENSTAT Analyses*. Chapman and Hall.
• Sprent P. 1993. *Applied Non-parametric Statistical Methods*. 2nd Ed. Chapman & Hall.
• Tufte ER. 1983. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Conn.
• Velleman PF and Hoaglin DC. 1981. *Application, Basics and Computing of Exploratory Data Analysis*. Duxbury Press.
• Weisberg S. 1985. *Applied Linear Regression*. John Wiley.
• Wetherill GB. 1982. *Elementary Statistical Methods*. Chapman & Hall.
• Wetherill GB.1986. *Regression Analysis with Applications*. Chapman & Hall.
• Cleveland WS. 1994. *The Elements of Graphing Data*, 2nd Ed., Chapman & Hall
• http://freestatistics.altervista.org/en/learning.php.
http://freestatistics.altervista.org/en/stat.php.
http://www.cas.lancs.ac.uk/glossary_v1.1/main.html.
http://www.stat.sc.edu/~grego/courses/stat706/.
• www.drs.icar.gov.in.

MCA 501: Computer Fundamentals and Programming (2+1)

Aim of the course

This is a course on Computer Fundamentals and Programming that aims at exposing the students to understand how computer works, analytical skills to solve problems using computers. And to write computer programs using C.

Theory

Unit I

Functional units of computer, I/O devices, primary and secondary memories. Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, Operator precedence, character representation; ASCII, Unicode.

Unit II

Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Constants and variables; Data types: integer, character, real, data types; Arithmetic expressions, assignment statements, logical expressions. Control flow

Unit III

Arrays and structures. Pointers, dynamic memory allocations

Unit IV

Program Structures – functions, subroutines. I/O operations, Program correctness; Debugging and testing of programs.

Practical

- Conversion of different number types;
- Creation of flow chart, conversion of algorithm/flowchart to program;
- Mathematical operators, operator precedence;
- Sequence, control and iteration;
- Arrays and string processing;
- Matrix operations, Sorting, Pointers and File processing – Reading and writing text files.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Balaguruswamy E. 2019. *Programming with ANSI C*. Tata McGraw Hill.
- Gottfried B. 2017. *Programming with C, Schaum Outline Series*. Tata McGraw Hill.
- Kanetkar Y. 1999. *Let Us C*. BPB Publ.
- Malvino A.P. and Brown J.A.. 2017. *Digital Computer Electronics*. Tata McGraw Hill.
- Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.

MCA 502: Computer Organization and Architecture (2+0)

Aim of the course

This is a course on Computer Organization and Architecture that aims at exposing the students to understand basic knowledge of how computer works.

Theory

Unit I

Number systems; Boolean algebra - minimization of Boolean function using Karnaugh Map.

Unit II

Logic Gates, Combinational circuits – multiplexer, de-multiplexer, encoder, decoder; Sequential circuits: Flip-flops, Half and Full adder, Shift register, Counters. Organization of CPU, Control Unit- Instruction and Execution cycle in CPU, Register Organization, The Instruction Cycle, Instruction Pipelining.

Unit III

Memory organization - Internal memory: Semiconductor Main Memory (RAM, ROM, EPROM), Cache Memory, Advanced DRAM Organization; External Memory - Magnetic Disks, RAID, Optical Memory, Magnetic Tape. Basic structure of computer hardware and system software - Addressing methods and machine programme sequencing; Input-output organizations - accessing I/O devices - direct memory access (DMA) – interrupts.

Unit IV

Introduction to microprocessors – CISC and RISC Architecture, Study of functional units of microprocessors.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Gear C.W. 1974. *Computer Organization and Programming*. McGraw Hill.
• Hayes J.P. 1988. *Computer Architecture and Organisation*. McGraw Hill.
• Malvino A.P and Brown J.A. 1999. *Digital Computer Electronics*. Tata McGraw Hill.
• Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.
• Mano M.M. 2007. *Computer System Architecture*. Prentice Hall of India.
• Stallings W. 2016. *Computer Organization and Architecture: Designing for Performance*. Pearson Edu.

MCA 511: Introduction to Networking and Internet Applications (1+1)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand Computer networking and web applications development.

Theory

Unit I

Networking fundamentals, types of networking, network topology; Introduction to File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol (SMTP), Internet Protocol v4 & v6.

Unit II

Network infrastructure and Security-switches, routers, firewall, intranet, internet, Virtual Private Network. World Wide Web (www), working with Internet; Web pages, web sites, web servers; Web Applications.

Unit III

Hyper Text Markup Language (HTML), DHTML, web based application development.

UNIT IV

Static websites, dynamic websites. Client Side processing – scripting languages, Jquery. Server Side processing ASP.NET/JSP

Practical

- Network and mail configuration;
- Using Network Services;
- Browsing of Internet;
- Creation of web pages;
- Creation of websites using HTML and scripting languages.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cox V, Wermers L and Reding E.E. 2006. *HTML Illustrated Complete*. 3rd Ed. Course Technology.
- Niederst J. 2001. *Web Design in a Nutshell*. O'Reilly Media.
- Tanenbaum A.S. 2003. Computer Networks. *Prentice* Hall of India.

MCA 512: Information Technology in Agriculture (2+0)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand analogy of computer, basic knowledge of MS Office. Also to understand Internet and WWW, use of IT application and different IT tools in Agriculture

Theory

Unit I

Introduction to Computers, Anatomy of computer, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions,

Unit II

Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications,

Unit III

Use of ICT in Agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc.,

Unit IV

Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions, Preparation of contingent crop-planning using IT tools.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Vanitha G. 2011. *Agro-informatics*
• http://www.*agrimoon*.com
• http://www.agriinfo.in
• http://www.eagri.org
• http://www.agriglance.com
• http://agritech.tnau.ac.in

BCM 501: Basic Biochemistry (3+1)

Why this course?
To impart the fundamental knowledge on structure and function of cellular components involved in biological processes and an elementary introduction to the study of molecular biology.

Aim of the course
The course is designed to provide elementary knowledge/overview of structure and function of proteins, carbohydrates, lipids, nucleic acids and other biomolecules and their metabolism.

Theory
UNIT-I
Block 1: Introduction to Biochemistry-8
Section 1: Scope and importance of biochemistry (1 Lecture)
Biochemistry as modern science and its various divisions, Scope and importance of biochemistry in agriculture and allied sciences.
Section 2: Foundation of life (2 Lectures)
Fundamental principles governing life, supramolecular structures, significance of weak non covalent interactions in biology
Section 3: Water (3 Lectures)
Structure of water, ionization of water, acid base concept, pH and buffers, significance of structure-function relationship.
Section 4: Physical techniques for structure determination (2 Lectures)
General introduction to physical techniques for determination of structure of biopolymers.

UNIT-II
Block 2: Structure And Function of Biomolecules -15
Section 1: Biomolecules (10 Lectures)
Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids.
Section 2: Immunoglobulins and PR proteins (2 Lectures)
Structure, formation and different forms of immunoglobulins, PR proteins and their classification.
Section 3: Plant secondary metabolites (3 Lectures)
Structure, classification and function of plant secondary metabolites.

UNIT-III
Block 3: Metabolism – The Basics
Section 1: Molecules aiding metabolism (2 Lectures)
Structure and biological functions of vitamins and coenzymes, enzymes: classification and mechanism of action; regulation, factors affecting enzyme action. Hormones: animal and plants.
Section 2: Thermodynamics –principles and energetic of life (2 Lectures)
Fundamentals of thermodynamic principles applicable to biological processes, Bioenergetics.

Block 4: Catabolism and its Regulation

Section 1: Catabolism of energy molecules (5 Lectures)

Important and basic degradative metabolic pathways of carbohydrates, lipids and proteins and their regulation.

Section 2: ATP formation (3 Lectures)

Formation of ATP, substrate level phosphorylation, electron transport chain and oxidative phosphorylation, chemiosmotic theory and proton motive force.

UNIT-IV

Block 5: Fundamentals of Molecular Biology and Genetic Engineering

Section 1: Molecular biology processes (4 Lectures)

Overview of replication, transcription and translation.

Section 2: Recombinant DNA technology (3 Lectures)

Restriction enzymes, DNA cloning, applications of cloning, transgenics.

Practicals

- Preparation of standard and buffer solutions
- Detection of carbohydrates, amino acids and proteins
- Extraction and estimation of sugars
- Extraction and estimation of amino acids
- Extraction and estimation of proteins
- Estimation of acid value of fat/oil
- Estimation of peroxide value of fat/oil
- Estimation of saponification value in fats and oils
- Fatty acid composition in fat/oil by GC
- Estimation of DNA and RNA by spectroscopic methods
- Estimation of Ascorbic acid
- Separation of biomolecules by TLC and Paper chromatography
- Estimation of alpha amylase activity
- Qualitative tests for secondary plant metabolites.

Teaching methods/activities

– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz

Learning outcome

With this course, the students are expected to be able to understand the actual chemical concepts and fundamental processes of biology at molecular level.

Suggested Reading

- Nelson DL and Cox MM. 2017. *Lehninger Principles of Biochemistry*. 7th edition. W. H. Freeman & Co Ltd
- Satyanarayana U and Chakrapani U. 2017. *Biochemistry*. 5th edition, Elsevier
- Moran LA, Horton HR, Scrimgeour KG and Perry MD. 2012. *Principles of Biochemistry*. 5th edition Pearson.
- Voet D and Voet JG. 2011. *Biochemistry*. 4th edition John Wiley.
- Pratt CW and Cornely K. 2014. *Essential Biochemistry*. 3rd Edition. Wiley
- Moorthy K. 2007. *Fundamentals of Biochemical Calculations*. 2nd edition. CRC Press
- Conn EE, Stumpf PK, Bruening G and Doi RH. 2006. *Outlines of Biochemistry*. 5th edition. Wiley.

BCM 505: Techniques in Biochemistry (2+2)

Why this course?

Biochemical studies rely on the availability of appropriate analytical techniques and their applications. This course will examine modern methods and technologies that are used in biochemical analysis with emphasis on instrumentation, underlying principles, aims, strategies and current applications.

Aim of the course

To provide hands-on experience to different biochemical techniques commonly used in research along with the knowledge on principles and the instrumentation**.**

Theory

Unit I

Block 1: Separation Techniques

Principles and applications of separation techniques.

Section 1: Chromatography techniques (4 Lectures)

Principles and applications of paper, thin layer, gel filtration, ion-exchange, affinity, column & HPTLC, GC, HPLC and FPLC.

Section 2: Electrophoretic technique (2 Lectures)

General principles, paper and gel electrophoresis, native and SDS-PAGE, 2D-PAGE, capillary electrophoresis.

Section 3: Hydrodynamic methods (2 Lectures)

Hydrodyanmic methods of separation of biomolecules such as viscosity and sedimentation velocity, - their principles.

Section 4: Centrifugation (2 Lectures)

Basic principles of sedimentation, type, care and safety aspects of centrifuge preparative and analytical centrifugation.

Unit II

Block 2: Spectroscopic Techniques

Section 1: Spectrophotometry (3 Lectures)

Principles and applications of UV-visible, Fluorescence, IR and FTIR, Raman, NMR and FTNMR, ESR and X-Ray spectroscopy.

Section 2: Mass spectroscopy (3 Lectures)

MS/MS, LC-MS, GC-MS, MALDI-TOF, applications of mass spectrometry in biochemistry.

Section 3: Atomic absorption spectrophotometry (2 Lectures)

Principle, function and instrumentation of atomic absorption spectrophotometry.

Unit III

Block 3. Microscopy

Section 1: Microscopic techniques (2 Lectures)

Principles and applications, light, UV, phase contrast, fluorescence and electron microscopy, flow cytometry.

Unit IV

Block 4: Tracer, Imaging, Immunochemical and Other Techniques

Section 1: Tracer technique (2 Lectures)

Tracer techniques in biology: concept of radioactivity, radioactivity counting methods with principles of different types of counters, concept of á, â and ã emitters, scintillation counters, Gamma-ray spectrometers, autoradiography, applications of radioactive tracers in biology.

Section 2: Imaging techniques (2 Lectures)

Principles and applications of phosphor imager, MRI and CT scan.

Section 3: Immunochemical technique (2 Lectures)

Production of antibodies, immunoprecipitation, immunoblotting, immunoassays, RIA and ELISA.

Section 4: Other techniques (2 Lectures)

Cryopreservation, polymerase chain reaction (PCR), FACS.

Practicals

- Expression of concentration in terms of dilution, molarity, normality, percent expression
- pH measurement and buffer preparation
- Determination of absorption maxima of biomolecules
- Estimation of biomolecules through spectrophotometry and other methods
- Separation of carbohydrates and amino acids by paper chromatography
- Separation and analysis of fatty acids/lipids by GC
- Separation/estimation of biomolecules through HPLC and FPLC
- Separation of proteins using ion exchange, gel filtration and affinity chromatography
- Electrophoretic separation of proteins and nucleic acids
- Centrifugation- differential and density gradient
- (NH4)2SO4 precipitation and dialysis
- Use of radioisotopes in metabolic studies
- PCR
- ELISA
- Western blotting/ Dot blotting

Teaching methods/activities

– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz
– Case study

Learning outcome

At the end of the course, the student will acquire the basic knowledge of the main biochemical methods used in the separation, identification, characterization and analysis of biomolecules.

Suggested Reading

• Boyer R. 2011. *Biochemistry Laboratory: Modern Theory and Techniques* 2nd Edition. Pearson
• Hofmann A and Clokie S. 2010. *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*. 7th edition. Cambridge University Press.
• Sawhney SK and Singh R. 2000. *Introductory Practical Biochemistry*. 2nd Ed. Narosa
• Katoch R. 2011. *Analytical Techniques in Biochemistry and Molecular Biology*. Springer
• Boyer R. 2009. *Modern Experimental Biochemistry*. Fifth impression. Pearson
• Lottspeich F and Engels JW. (Eds). 2018. *Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology.* Wiley-VCH
• Wilson K and Walker J. 2010. *Principles and Techniques of Biochemistry and Molecular Biology*, 7th Edition. Cambridge University Press

COURSES FOR M. Sc. (AGRI.) IN AGRONOMY

Code	Course Title	Credits	Credit Pattern	Credit Value
Agron 501* #	Modern Concepts in Crop Production	3	3+0	3
Agron 502* #	Principles and practices of soil fertility and nutrient management	3	2+1	3
Agron 503* #	Principles and Practices of Weed Management	3	2+1	3
Agron 504* #	Principles and Practices of Water Management	3	2+1	3
Agron 505	Conservation Agriculture	2	1+1	2
Agron 506 #	Agronomy of major Cereals and Pulses	2	2+0	2
Agron507 #	Agronomy of oilseed, fibre and sugar crops	3	2+1	3
Agron 508	Agronomy of medicinal, aromatic & underutilized crops	3	2+1	3
Agron 509	Agronomy of fodder and forage crops	3	2+1	3
Agron 510	Agrostology and Agro- Forestry	3	2+1	3
Agron 511	Cropping System and Sustainable Agriculture	2	2+0	2
Agron 512 #	Dryland Farming and Watershed Management	3	2+1	3
Agron 513	Principles and practices of organic farming	3	2+1	3
Agron 581	Qualifying Examination	2	0+2	2
Agron 591	Master's seminar I	1	0+1	1
Agron 592	Master's seminar II	1	0+1	1
Agron 599	Master's research	27	0+27	27

*** Courses identified as compulsory core courses for Master's students by ICAR**

 # Courses identified as compulsory core courses for Master's students by SIIASHT

All other courses listed are eligible to be treated as Minor courses

SYLLABUS FOR AGRONOMY COURSES FOR M. Sc. (AGRI.) IN AGRONOMY

Agron 501: Modern Concepts in Crop Production

(3+0)

Aim of the course
To teach the basic concepts of soil management and crop production.

Theory
Unit I
Crop growth analysis in relation to environment; geo-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

Unit II
Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

Unit III
Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition.

Unit IV
Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture. Modern crop production concepts: soil less cultivation, Aeroponic, Hydroponic, Robotic and terrace farming. use of GIS, GPS and remote sensing in modern agriculture, precision farming and protected agriculture.

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Class discussion

Learning outcome
Basic knowledge on soil management and crop production

Suggested Reading

- Balasubramaniyan P and Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.
- Fageria NK. 1992. *Maximizing Crop Yields*. Marcel Dekker.
- Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. *Soil Fertility and Fertilizers.* 7th Ed. Prentice Hall.
- Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.
- Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.
- Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
- Alvin PT and kozlowski TT (ed.). 1976. *Ecophysiology of Tropical Crops*. Academia Pul., New York.
- Gardner PP, Pearce GR and Mitchell RL. 1985. *Physiology of Crop Plants*. Scientific Pub. Jodhpur.
- Lal R. 1989. *Conservation tillage for sustainable agriculture: Tropics versus Temperate Environments. Advances in Agronomy* 42: 85-197.
- Wilsie CP. 1961. *Crop Adaptation and Distribution*. Euresia Pub., New Delhi.

Agron 502: Principles and Practices of Soil Fertility and Nutrient Management (2+1)

Aim of the course

To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.

Theory

Unit I

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions. Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

Unit II

Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.

Unit III

Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency; agronomic, chemical and physiological, fertilizer mixtures and grades; methods of increasing fertilizer use efficiency; nutrient interactions.

Unit IV

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management; use of vermincompost and residue wastes in crops.

Practical

- Determination of soil pH and soil EC
- Determination of soil organic C
- Determination of available N, P, K and S of soil
- Determination of total N, P, K and S of soil
- Determination of total N, P, K, S in plant
- Computation of optimum and economic yield

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Class discussion

Learning outcome

Basic knowledge on soil fertility and management

Suggested Reading

• Brady NC and Weil RR. 2002. *The Nature and Properties of Soils.* 13th Ed. Pearson Edu.
• Fageria NK, Baligar VC and Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops.* Marcel Dekker.
• Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. *Soil Fertility and Fertilizers.* 7th Ed. Prentice Hall.
• Prasad R and Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.
• Yawalkar KS, Agrawal JP and Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

Agron 503: Principles and Practices of Weed Management

(2+1)

Aim of the course
To familiarize the students about the weeds, herbicides and methods of weed control.

Theory
Weed biology, and ecology and classification, crop-weed competition including allelopathy; principles and methods of weed control and classification management; weed indices, weed shift in different eco-systems. Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides. Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures,

Unit II
Application of Herbicides- sequential application of herbicides, rotation; weed control through use of nano-herbicides and bio-herbicides, myco-herbicides bio-agents, and allelochemicals; movement of herbicides in soil and plant, Degradation of herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation.

Unit III
Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area.

Unit IV
Integrated weed management; recent development in weed management- robotics, use of drones and aeroplanes, organic etc., cost: benefit analysis of weed management.

Practical
- Identification of important weeds of different crops,
- Preparation of a weed herbarium, Weed survey in crops and cropping systems,
- Crop-weed competition studies, Weed indices calculation and interpretation with data,
- Preparation of spray solutions of herbicides for high and low-volume sprayers,
- Use of various types of spray pumps and nozzles and calculation of swath width,
- Economics of weed control, Herbicide resistance analysis in plant and soil,
- Bioassay of herbicide resistance residues,
- Calculation of herbicidal herbicide requirement

PEDAGOGY (Teaching methods/activities)
- Classroom teaching with AV aids,
- Group discussion,
- Field visit to identify weeds.

Learning outcome

Basic knowledge on weed identification and control for crop production

Suggested Reading

- Böger, Peter, Wakabayashi, Ko, Hirai, Kenji (Eds.). 2002. *Herbicide Classes in Development*. *Mode of Action, Targets, Genetic Engineering, Chemistry*. Springer.
- Chauhan B and Mahajan G. 2014. *Recent Advances in Weed Management*. Springer.
- Das TK. 2008. *Weed Science: Basics and Applications*, Jain Brothers (New Delhi).
- Fennimore, Steven A and Bell, Carl. 2014. *Principles of Weed Control*, 4th Ed, California Weed Sci. Soc.
- Gupta OP. 2007. *Weed Management*: *Principles and Practices*, 2nd Ed.
- Jugulan, Mithila (ed). 2017. *Biology, Physiology and Molecular Biology of Weeds*. CRC Press
- Monaco TJ, Weller SC and Ashton FM. 2014. *Weed Science Principles and Practices*, Wiley
- Powles SB and Shaner DL. 2001. Herbicide Resistance and World Grains, CRC Press.
- Walia US. 2006. *Weed Management*, Kalyani.
- Zimdahl RL. (ed). 2018. *Integrated Weed Management for Sustainable Agriculture, B. D. Sci. Pub.*

Agron 504: Principles and Practices of Water Management

(2+1)

Aim of the course

To teach the principles of water management and practices to enhance the water productivity

Theory

Unit I

Water and its role in plants; Irrigation: Definition and objectives, water resources and irrigation development in of India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states. Field water cycle, water movement in soil and plants; transpiration; soil-water plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. Water availability and its relationship with nutrient availability and loses.

Unit II

Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and polyhouses. Irrigation efficiency and water use efficiency. Water management of crop and cropping system, Quality of irrigation water and management of saline water for irrigation, water use efficiency, Crop water requirement- estimation of ET and effective rainfall; Water management of the major crops and cropping systems. Automated irrigation system.

Unit III

Excess of soil water and plant growth; water management in problem soils, drainage requirement of crops and methods of field drainage, their layout and spacing; rain water management and its utilization for crop production. Quality of irrigation water and management of saline water for irrigation, water management in problem soils

Unit IV

Soil moisture conservation, water harvesting, rain water management and its utilization for crop production. Hydroponics, Water management of crops under climate change scenario.

Practical

- Determination of Field capacity by field method
- Determination of Permanent Wilting Point by sunflower pot culture technique
- Determination of Field capacity and Permanent Wilting Point by Pressure Plate Apparatus
- Determination of Hygroscopic Coefficient
- Determination of maximum water holding capacity of soil
- Measurement of matric potential using gauge and mercury type tensiometer
- Determination of soil-moisture characteristics curves
- Determination of saturated hydraulic conductivity by constant and falling head method

- Determination of hydraulic conductivity of saturated soil below the water table by auger hole method
- Measurement of soil water diffusivity
- Estimation of unsaturated hydraulic conductivity
- Estimation of upward flux of water using tensiometer and from depth ground water table
- Determination of irrigation requirement of crops (calculations)
- Determination of effective rainfall (calculations)
- Determination of ET of crops by soil moisture depletion method16. Determinationof water requirements of crops
- Measurement of irrigation water by volume and velocity-area method
- Measurement of irrigation water by measuring devices and calculation of irrigation efficiency
- Determination of infiltration rate by double ring infiltrometer

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Field visit

Learning outcome

Basic knowledge on water management for optimization of crop yield

Suggested Reading

- Majumdar DK. 2014. *Irrigation Water Management: Principles and Practice*. PHL Learning private publishers
- Mukund Joshi. 2013. *A Text Book of Irrigation and Water Management Hardcover*, Kalyani publishers
- Lenka D. 1999. *Irrigation and Drainage*. Kalyani.
- Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
- Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, New Delhi.
- Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.
- Prihar SS and Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
- Singh Pratap and Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publ.

Agron 505: Conservation Agriculture (1+1)

Aim of the course
To impart knowledge of conservation of agriculture for economic development.

Theory
Unit I
Conventional and conservation agriculture systems, sustainability concerns, conservation agriculture: Historical background and present concept, global experiences, present status in India.

Unit II
Nutrient management in conservation agriculture, water management, weed management, energy use, insect-pest and disease management, farm machinery, crop residue management, cover crop management.

Unit III
Climate change mitigation and conservation agriculture, C-sequestration, soil health management, soil microbes and conservation agriculture.

Unit IV
conservation agriculture in agroforestry systems, rainfed / dryland regions. Economic considerations in conservation agriculture, adoption and constraints, conservation agriculture : The future of agriculture

Practicals
• Study of long-term experiments on CA,
• Evaluation of soil health parameters,
• Estimation of C-sequestration,
• Machinery calibration for sowing different crops, weed seedbank estimation under CA, energy requirements, economic analysis of CA.

PEDAGOGY (Teaching methods/activities)
- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Class discussion

Learning outcome
Experience on the knowledge of various types of conservation of agriculture.

Suggested Reading

- Arakeri HR and Roy D. 1984. *Principles of Soil Conservation and Water Management*. Oxford & IBH.
- Bisht JK, Meena VS, Mishra PK and Pattanayak A. 2016. Conservation Agriculture-An approach to combat climate change in Indian Himalaya. Publisher: Springer Nature. Doi: 10/1007/978-981-10-2558-7.
- Dhruvanarayana VV. 1993. *Soil and Water Conservation Research in India*. ICAR.
- FAO. 2004. *Soil and Water Conservation in Semi-Arid Areas*. *Soils Bull.,* Paper 57.
- Gracia-Torres L, Benites J, Martinez-Vilela A and Holgado-Cabera A. 2003. Conservation Agriculture- Environment Farmers experiences, innovations Socio-economic policy.
- Muhammad F and Kamdambot HMS. 2014. Conservation Agriculture. Publisher: Springe Cham Heidelberg, New Yaork Dordrecht London. Doi: 10.1007/978-3-319-11620-4.
- Yellamanda Reddy T and Sankara Reddy GH. 1992. *Principles of Agronomy*. Kalyani.

Agron 506: Agronomy of Major Cereals and Pulses

(2+0)

Aim of the course
To impart knowledge of crop husbandry of cereals and pulse crops.

Theory
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of:

Unit I
Rabi cereals.

Unit II
Kharif cereals.

Unit III
Rabi pulses.

Unit IV
Kharif pulses.

Practical
- Phenological studies at different growth stages of crop
- Estimation of crop yield on the basis of yield attributes
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
- Working out growth indices (CGR, RGR, NAR, LAI, LAD, LAR, LWR, SLA, SLW, etc)
- Assessment of land use and yield advantage (Rotational intensity, Cropping intensity, Diversity Index, Sustainable Yield Index Crop Equivalent Yield, Land Equivalent ration, Aggressiveness, Relative Crowding Coefficient, Competition Ratio and ATER etc)
- Estimation of protein content in pulses
- Planning and layout of field experiments
- Judging of physiological maturity in different crops
- Intercultural operations in different crops
- Determination of cost of cultivation of different crops
- Working out harvest index of various crops
- Study of seed production techniques in selected crops
- Visit of field experiments on cultural, fertilizer, weed control and water management aspects
- Visit to nearby villages for identification of constraints in crop production

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Class discussion

Learning outcome

Basic knowledge on cereals and pulses being grown in the country .

Resources

• Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
• Hunsigi G and Krishna KR. 1998. *Science of Field Crop Production*. Oxford & IBH.
• Jeswani LM and Baldev B. 1997. *Advances in Pulse Production Technology*.ICAR.
• Khare D and Bhale MS. 2000. *Seed Technology*. Scientific Publ.
• Kumar Ranjeet and Singh NP. 2003. *Maize Production in India: Golden Grain in Transition*. IARI, New Delhi.
• Pal M, Deka J and Rai RK. 1996. *Fundamentals of Cereal Crop Production*.Tata McGraw Hill.
• Prasad Rajendra. 2002. *Text Book of Field Crop Production*. ICAR.
• Singh C, Singh P and Singh R. 2003. *Modern Techniques of Raising FieldCrops*. Oxford & IBH.
• Singh SS. 1998. *Crop Management*. Kalyani.
• Yadav DS. 1992. *Pulse Crops*. Kalyani.

Agron 507: Agronomy of Oilseed, Fibre and Sugar Crops

(2+1)

Aim of the course
To teach the crop husbandry of oilseed, fiber and sugar crops

Theory
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of:

Unit I
Rabi oilseeds – Rapeseed and mustard, Linseed and Niger

Unit II
Kharif oilseeds - Groundnut, Sesame, Castor, Sunflower, Soybean and Safflower

Unit III
Fiber crops - Cotton, Jute, Ramie and Mesta.

Unit IV
Sugar crops – Sugar-beet and Sugarcane.

Practical
- Planning and layout of field experiments
- Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane
- Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice phenological studies at different growth stages of crop
- Intercultural operations in different crops
- Cotton seed treatment
- Working out growth indices (CGR, RGR, NAR, LAI, LAD, LAR, LWR, SLA, SLW, etc)
- Assessment of land use and yield advantage (Rotational intensity, Cropping intensity, Diversity Index, Sustainable Yield Index Crop Equivalent Yield, Land Equivalent ration, Aggressiveness, Relative Crowding Coefficient, Competition Ratio and ATER etc)
- Judging of physiological maturity in different crops and working out harvest index
- Working out cost of cultivation of different crops
- Estimation of crop yield on the basis of yield attributes
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
- Determination of oil content in oilseeds and computation of oil yield
- Estimation of quality of fibre of different fibre crops
- Study of seed production techniques in various crops
- Visit of field experiments on cultural, fertilizer, weed control and water management aspects
- Visit to nearby villages for identification of constraints in crop production

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Class discussion

Learning outcome

Basic knowledge on production of oil seed, sugar and fibre crops.

Suggested Reading

• Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
• Das PC. 1997. *Oilseed Crops of India*. Kalyani.
• Lakshmikantam N. 1983. *Technology in Sugarcane Growing*. 2nd Ed. Oxford & IBH.
• Prasad Rajendra. 2002. *Text Book of Field Crop Production*. ICAR.
• Singh C, Singh P & Singh R. 2003. *Modern Techniques of Raising Field Crops.* Oxford & IBH.
• Singh SS. 1998. *Crop Management*. Kalyani.

Agron 508: Agronomy of Medicinal, Aromatic and Under Utilized Crops (2+1)

Aim of the course

To acquaint students about different medicinal, aromatic and underutilized field crops, their package of practices and processing.

Theory

Unit I

Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and their uses, export potential and indigenous technical knowledge.

Unit II

Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Mulhati, Isabgol, Rauwolfia, Poppy, *Aloe vera*, Satavari, *Stevia*, Safed Musli, Kalmegh, Asaphoetida, *Nuxvomica*, Rosadle, Citronella, Lemon grass, Palmarosa, etc).

Unit III

Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Mentha, Basil, Rose, Patchouli, Geranium). Climate and soil requirements; cultural practices; yield of under-utilized crops (Rice bean, Lathyrus, Sesbania, Clusterbean, French bean)

Unit IV

Climate and soil requirements; cultural practices; yield of under-utilized crops –(Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco). Post harvest handling –drawing, processing, grading, packing and storage, value addition and quality standards in herbal products.

Practical

- Identification of crops based on morphological and seed characteristics
- Raising of herbarium of medicinal, aromatic and under-utilized plants
- Quality characters in medicinal and aromatic plants
- Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Field visit

Learning outcome

Acquainted with various MAP and their commercial base for developing entrepreneurship.

Suggested Reading

- Chadha KL and Gupta R. 1995. *Advances in Horticulture*. Vol. II. *Medicinal and Aromatic Plants*. Malhotra Publ.
- Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
- Handa SS. 1984. *Cultivation and Utilization of Medicinal Plants*. RRL, CSIR, Jammu.
- Hussain A. 1984. *Essential Oil Plants and their Cultivation*. CIMAP, Lucknow.
- Hussain A. 1993. *Medicinal Plants and their Cultivation.* CIMAP, Lucknow.
- ICAR 2006. *Hand Book of Agriculture.* ICAR, New Delhi.
- Kumar N, Khader Md. Abdul, Rangaswami JBM & Irulappan 1997. *Introduction to Spices,Plantation Crops, Medicinal and Aromatic Plants.* Oxford & IBH.
- Prajapati ND, Purohit SS, Sharma AK and Kumar T. 2003. *A Hand Book of Medicinal Plants: A Complete Source Book*. Agrobios.
- Sharma R. 2004. *Agro-Techniques of Medicinal Plants*. Daya Publ. House.

Agron 509: Agronomy of Fodder and Forage Crops (2+1)

Aim of the course
To teach the crop husbandry of different forage and fodder crops along with their processing.

Theory
Unit I
Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like sorghum, maize, *bajra*, *guar*, cowpea, oats, barley, berseem, *senji*, lucerne, etc.

Unit II
Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses - lime, Napier grass, *Panicum, Lasiuras, Cenchrus,* etc.

Unit III
Year-round fodder production and management, preservation and utilization of forage and pasture crops.

Unit IV
Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Fodder production through hydroponics. Azolla cultivation.
Economics of forage cultivation uses and seed production techniques of important fodder crops.

Practical
- Practical training of farm operations in raising fodder crops;
- Canopy measurement, yield, Leaf: Stem ratio and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose and IVDMD, etc. of various fodder and forage crops
- Anti-quality components like HCN in sorghum and such factors in other crops
- Hay and silage making and economics of their preparation.

PEDAGOGY (Teaching methods/activities)
- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Field visit

Learning outcome
Acquainted with various fodder and forage crops and their commercial base for developing entrepreneurship.

Suggested Reading

• Chatterjee BN. 1989. *Forage Crop Production - Principles and Practices*. Oxford & IBH.
• Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
• Narayanan TR and Dabadghao PM. 1972. *Forage Crops of India*. ICAR.
• Singh P and Srivastava AK. 1990. *Forage Production Technology*. IGFRI, Jhansi.
• Singh C, Singh P and Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH.
• Tejwani KG. 1994. *Agroforestry in India*. Oxford & IBH.

Agron 510: Agrostology and Agro-forestry (2+1)

Aim of the course
To teach crop husbandry of different forage, fodder and agroforestry crops/trees along with their processing.

Theory
Unit I
Agrostology: definition and importance; principles of grassland ecology: grassland ecology – community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India; problems and management of grasslands.

Unit II
Importance, classification (various criteria), scope, status and research needs of pastures; pasture establishment, their improvement and renovation-natural pastures, cultivated pastures; common pasture grasses.

Unit III
Agroforestry: definition and importance; agro-forestory systems, agri-silviculture, silvi-pasture, agri-silvi-pasture, agri-horticulture, aqua-silviculture, alley cropping and energy plantation.

Unit IV
Crop production technology in agro-forestory and agrostology system; silvipastoral system: meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination in agro-forestry systems; irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences; lopping and coppicing in agroforestry systems; social acceptability and economic viability, nutritive value of trees; tender operation; desirable tree characteristics.

Practical
- Preparation of charts and maps of India showing different types of pastures and agro-forestry systems
- Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry
- Seed treatment for better germination of farm vegetation
- Methods of propagation/ planting of grasses and trees in silvipastoral system
- Fertilizer application in strip and silvipastroal systems
- After-care of plantation
- Estimation of protein content in loppings of important fodder trees
- Estimation of calorie value of wood of important fuel trees
- Estimation of total biomass and fuel wood
- Economics of agro-forestry
- Visit to important agro-forestry research stations

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment and
- Field visit

Learning outcome

Basic knowledge on agro forestry, forage crops and their utility

Suggested Reading

• Chatterjee BN and Das PK. 1989. *Forage Crop Production. Principles and Practices.* Oxford & IBH.

• Dabadghao PM and Shankaranarayan KA. 1973. *The Grass Cover in India*. ICAR.

• Dwivedi AP. 1992. *Agroforestry- Principles and Practices.* Oxford & IBH.

• Indian Society of Agronomy. 1989. *Agroforestry System in India. Research and Development,* New Delhi.

• Narayan TR and Dabadghao PM. 1972. *Forage Crop of India*. ICAR, New Delhi.

Agron 511: Cropping Systems and Sustainable Agriculture

(2+0)

Aim of the course

To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

Theory

Unit I

Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use. Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.

Unit II

Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture.

Unit III

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.

Unit IV

Plant ideotypes for drylands; plant growth regulators and their role in sustainability. Artificial Intelligence- Concept and application.

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment.

Learning outcome

Basic knowledge on cropping system for sustainable agriculture.

Suggested Reading

• Panda SC. 2017. *Cropping Systems and Sustainable Agriculture*. Agrobios (India)
• Panda SC. 2018. *Cropping and Farming Systems*. Agrobios.
• Palaniappan SP and Sivaraman K. 1996. *Cropping Systems in the Tropics; Principles and Management.* New Age.
• Panda SC. 2003. *Cropping and Farming Systems*. Agrobios.
• Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
• Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy.* The Bangalore Printing & Publ. Co.
• Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
• Tisdale SL, Nelson WL, Beaton JD and Havlin JL. 1997. *Soil Fertility and Fertilizers*. Prentice Hall.

Agron 512: Dryland Farming and Watershed Management (2+1)

Aim of the course
To teach the basic concepts and practices of dry land farming and soil moisture conservation.

Theory
Unit I
Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

Unit II
Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

Unit III
Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.

Unit IV
Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use. Concept of watershed resource management, problems, approach and components.

Practical
- Method of Seed Priming
- Determination of moisture content of germination of important dryland crops
- Determination of Relative Water Content and Saturation Deficit of Leaf
- Moisture stress effects and recovery behaviour of important crops
- Estimation of Potential ET by Thornthwaite method
- Estimation of Reference ET by Penman Monteith Method
- Classification of climate by Thornthwaite method (based on moisture index, humidity index and aridity index)
- Classification of climate by Koppen Method
- Estimation of water balance by Thornthwaite method
- Estimation of water balance by FAO method
- Assessment of drought
- Estimation of length of growing period
- Estimation of probability of rain and crop planning for different drought condition
- Spray of anti-transpirants and their effect on crops
- Water use efficiency
- Visit to dryland research stations and watershed projects

PEDAGOGY (Teaching methods/activities)

- Classroom teaching with AV aids,
- Group discussion,
- Assignment.

Learning outcome

Basic knowledge on dry land farming and soil moisture conservation.

Suggested Reading

• Reddy TY. 2018. *Dryland Agriculture Principles and Practices*, Kalyani publishers
• Das NR. 2007. *Tillage and Crop Production*. Scientific Publ.
• Dhopte AM. 2002. *Agrotechnology for Dryland Farming*. Scientific Publ.
• Dhruv Narayan VV. 2002. *Soil and Water Conservation Research in India*. ICAR.
• Gupta US. (Ed.). 1995. *Production and Improvements of Crops for Drylands*. Oxford & IBH.
• Katyal JC and Farrington J. 1995. *Research for Rainfed Farming*. CRIDA.
• Rao SC and Ryan J. 2007. *Challenges and Strategies of Dryland Agriculture*. Scientific Publ.
• Singh P and Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture.* Agrotech Publ. Company.
• Singh RP. 1988. *Improved Agronomic Practices for Dryland Crops*. CRIDA.
• Singh RP. 2005. *Sustainable Development of Dryland Agriculture in India*. Scientific Publ.
• Singh SD. 1998. *Arid Land Irrigation and Ecological Management*. Scientific Publ.
• Venkateshwarlu J. 2004. *Rainfed Agriculture in India. Research and Development Scenario*. ICAR.

Agron 513: Principles and Practices of Organic Farming (2+1)

Aim of the course
To study the principles and practices of organic farming for sustainable crop production.

Theory
Unit I
Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; principles of organic agriculture; organics and farming standards; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation tillage; shelter zones, hedges, pasture management, agro-forestry.

Unit II
Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures, bio-fertilizers and biogas technology.

Unit III
Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

Unit IV
Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. Socio-economic impacts; marketing and export potential: inspection, certification, labelling and accreditation procedures; organic farming and national economy.

Practical
- Method of making compost by aerobic method
- Method of making compost by anaerobic method
- Method of making vermicompost
- Identification and nursery raising of important agro-forestry tress and tress for shelter belts
- Efficient use of biofertilizers, technique of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter, Azospirillum,* and PSB cultures in field
- Visit to a biogas plant
- Visit to an organic farm
- Quality standards, inspection, certification and labelling and accreditation procedures for farm produce from organic farms

PEDAGOGY (Teaching methods/activities)
- Classroom teaching with AV aids,
- Group discussion,
- Assignment.
- Exposure visit

Learning outcome

Basic knowledge on organic farming for sustainable agriculture and development of entrepreneurship on organic inputs.

Suggested Reading

• Ananthakrishnan TN. (Ed.). 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.
• Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.
• Joshi M. 2016. *New Vistas of Organic Farming*. Scientific Publishers
• Lampin N. 1990. *Organic Farming*. Press Books, lpswitch, UK.
• Palaniappan SP and Anandurai K. 1999. *Organic Farming – Theory and Practice*. Scientific Publ.
• Rao BV Venkata. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective*: Publ.3, Parisaraprajna Prathishthna, Bangalore.
• Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
• Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.
• Singh SP. (Ed.). 1994. *Technology for Production of Natural Enemies.* PDBC, Bangalore.
• Subba Rao NS. 2002. *Soil Microbiology*. Oxford & IBH.
• Trivedi RN. 1993. *A Text Book of Environmental Sciences*, Anmol Publ.
• Veeresh GK, Shivashankar K and Singlachar MA. 1997. *Organic Farming and Sustainable Agriculture.* Association for Promotion of Organic Farming, Bangalore.
• WHO. 1990. *Public Health Impact of Pesticides Used in Agriculture*. WHO.
• Woolmer PL and Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

PATTERN OF QUESTION PAPER FOR THE THEORY EXAMINATION

M.Sc. (Agri.) in AGRONOMY

(Semester Scheme - CBCS Pattern)

Time: 3 Hours Max. Marks: 70

Instructions: Answer all the questions.

SECTION – A: Define/explain ANY FIVE of the following: 5 x 2 = 10

(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)

1)

2)

3)

4)

5)

6)

7)

SECTION-B: Write short notes on ANY FOUR of the following: 4 x 5 = 20

(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)

8)

9)

10)

11)

12)

13)

SECTION-C: Explain in detail on ANY FOUR of the following: 4 x 10 = 40

(Questions from all the Units of the Syllabus by drawing minimum of one question form each unit)

14)

15)

16)

17)

18)

19)

Signature of the BOS Chairman

UNIVERSITY OF MYSORE

Crawford Hall, Vishwavidyanilaya Karya Soudha,
Mysuru, Karnataka - 570005

POST GRADUATE REGULATION & SYLLABUS
Specialized Progammes

FOR

M. Sc. (Agri.) in Entomology

Sampoorna International Institute of Agri. Sciences and Horticultural Technology

271/2, K.B. Doddi, Gram, Madapuri Doddi, Nidagatta Post, Maddur (tq), Mandya (Dist.)

2023-2024

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POST GRADUATE REGULATIONS 2023-2024

1. TITLE

The Academic Information and Regulations shall be called "University of Mysore Academic Information and Regulations governing **Post graduate Degree Programmes in Agriculture Subjects under Semester System of Specialised Programme**" to be offered by the Sampoorna International Institute of Agri. Science and Horticultural Technology in addition to the Academic Regulation of the University of Mysore. These shall be applicable for students admitted from the Academic year 2023-24 and onwards.

2. DEFINITIONS

2.1 Academic Year: An academic year is a period during which a cycle of study is completed. It shall consist of two Semesters. Dates of registration, commencement of Instructions, semester end examination and academic calendar shall be approved by the University of Mysore

2.2 Semester: A Semester shall consist of not less than 110 instructional days. The final examinations shall be completed in then extten working days.

2.3 Curriculum: A series of courses designed to provide learning opportunities to meet there quirements for a degree as per BSMA (Broad Subject Matter Area) norms of the Indian Council of Agriculture Research. Courses with 500 series are applicable for master's degree Programmes.

2.4 Course: A course is a unit of instruction or segment of subject matter as specified in course calendar to be covered in a semester. It has a specified number, title and credit hours.

2.5 Credit Hours (Course Credit): A measure of quantity of work done in a course. One credit represents one hour of lecture or 2 hours of laboratory or fieldwork per week through a semester.

2.6 Course Load: The number of credit hours a student can register in a semester. A student shall not register for more than 23 credits in a semester.

2.7 Grade Point of a Course: A measure of quality of work done in a course to meet the requirement in a semester. It is computed by dividing the percentage of marks obtained in a course by 10. It shall be expressed on a 10-point scale up to third decimal place. A grade point of 6.00 and above shall be considered as successful completion of the course.

2.8 Grade Point Average (GPA): It is a quotient of the total course credit points secured by a student in various courses registered divided by the course credits during that semester. It shall be corrected to the third decimal place.

2.9 Cumulative Grade Point Average (CGPA): It is the cumulative performance of a student in all the courses taken during all the preceding semesters. CGPA is computed by dividing the total credit points earned by a student in all the courses taken from the beginning of the first semester by the total number of credits completed up to the end of a specified semester. It shall be corrected to the third decimal place.

2.10 Overall Grade Point Average (OGPA): It is a measure of the overall performance of a student on completion of the degree programme. It is computed by dividing the total number of course credit points earned by a student over the semesters by the total number of credit hours and corrected to the third decimal place. A minimum of 7.00 OGPA is necessary for a pass for master's degree.

3. POST GRADUATE DEGREE PROGRAMMES

The following degree programmes are offered at the **Sampoorna International Institute of Agri. Science and Horticultural Technology**, under the aegis of the University of Mysore, Mysuru. The Post graduate programmes leading to MASTER'S DEGREE **M.Sc. (Agri.) in Entomology.**

4. MODE OF ADMISSION

Application for admissions will be notified by the Institution every year. Eligible and desiring students can apply in the prescribed form along with the copies of the necessary documents either online or offline as notified by the Institution from time to time. All post graduate students admitted tentatively after paying the prescribed fee notified by the institution and submission of the original documents to the Institution have to further register with the University of Mysore as per the norms by paying the prescribed fee. However, the admission will be valid only after the University of Mysore approves the candidacy of the students.

4.1 Criteria for admission

Indian Nationals with a four-year Basic degree in Agriculture, Horticulture, Sericulture, Forestry and /or related /allied Sciences with an Overall Grade Point Average of 6.00 (60 % Marks)in the basic degree are eligible to get the admission. The medium of instruction shall be in English. Criteria for admission shall be notified from time to time.

4.1.1 Indian Nationals with foreign degree, children of NRIs/Foreign Nationals with a similar or equivalent degree are also eligible to apply to the Institution for admission but are to be approved by the University of Mysore. On selection, they have to pay the prescribed fee of the Institution and submit

the original documents as required by the institution/University of Mysore notified from time to time.

Admission for the seats which are not reserved, shall be made strictly according to the merit as well as first come first serve basis as the course is self-financed. However, the allotment of the seat shall be determined as outlined below:

4.1.2 The admission of candidates is subject to the following conditions:

a) Seats being vacant.
b) Verification of original marks cards and other details furnished in the application.
c) Payment of prescribed fee to the SIIASHT be made on or before the notified date by the authorities of SIIASHT and the University of Mysore to that particular academic year, failing which the admission is liable to be cancelled and any amount paid is non-refundable.
d) Production of medical fitness certificate at the time of registration.
e) Submission of duly signed **Annexure – V (i)** Rules and Regulations, **Annexure V (ii)** & **V (iii)** Undertaking / Declaration, **Annexure – V (iv)** and **Annexure – V (v)**. Acceptance letter of Admission and **Annexure VI (i)** to **Annexure – VI (iv)**. Application form, Rules and Regulations with Undertaking of the Hostel for the hostelites of the SIIASHT are mandatory to be submitted by both the students and a responsible guardian or parent of the student.

5. RESIDENTIAL REQUIREMENTS

A minimum of TWO Academic years (FOUR semesters) shall ordinarily be required for the programme of course work, research, thesis preparation and examinations leading to the Master's Degree. However, the duration may be extended up to a maximum of EIGHT semesters. The institution has no provision to accommodate part time studentship.

5.1 During the entire degree programme, a student enrolled is expected to be a full-time student. As a consequence, he/she is not permitted to work during the two-year period of enrolment, except in research and teaching related works within the premises of the Institution.

5.2 All enrolled PG students shall, therefore, give the following undertaking at the time of registration for every semester till they complete their residential requirements:

I, ..., ID No .. …….. studying Master's degree in ……., hereby give the undertaking that I will be a fulltime student and will not work anywhere during the I/II Semester of the academic year ……..., failing which my admission be cancelled.

Date: Signature of the Student

(Forwarded by the Chairperson and PG Coordinator to the Dean)

5.3 Despite the above undertaking, if any PG student is found working outside the Institution during the period of registered semester, action will be taken to consider the specific semester as null and void. Therefore, the student may have to repeat the specific work registered for the semester.

6. TIME LIMIT FOR COMPLETION OF THE DEGREE

A candidate admitted to the Masters' degree programme may be declared qualified for the degree, provided the candidate completes all the prescribed requirements within EIGHT consecutive semesters from the date of admission irrespective of his / her registration, failing which the admission shall be deemed to have been cancelled.

7. MIGRATION CERTIFICATE

Candidates from other Universities should produce Migration Certificate within the completion of the first semester, failing which their admission will be cancelled.

8. REGISTRATION FOR THE FIRST SEMESTER

Candidates on receipt of admission notice from the Institution shall submit the original documents, pay the prescribed fee notified from time to time and register for the relevant courses in person on or before the last date specified, failing which they shall for feit their admission.

8.1 For those students who were admitted subsequently, attendance shall be counted from the date of their registration.

8.2 A student who registers for the first semester of the Academic Degree Programme should complete a minimum of SIX credit hours securing a grade point other than 'F'or'SA'(Shortage of Attendance) failing which his/her admission shall stand cancelled. This will not be applicable to re-admitted candidates.

8.3 However, in genuine cases of hospitalisation resulting in immobilisation, a student

can be exempted from the above clause provided sufficient proof is produced. The genuineness of such cases shall be examined and considered by a committee consisting of Dean of the Institution, Coordinator of PG studies and a Senior Professor in the Department/Institution.

9. REGISTRATION FOR THE SECOND AND SUBSEQUENT SEMESTERS

9.1 Registration for second and subsequent semesters shall commence TWO weeks prior to the closure of the ongoing semester.

9.1.1 The students registering for the courses shall do so in person/notified mode and by producing the ID card for verification at the time of Registration. Only under unavoidable circumstances, a student may be permitted by the Dean of the Institution to register in absentia.

The last date for registration without penal fee shall be the FIRST day of the semester.

9.1.2 However, students are permitted to register up to SIX working days after the last date, on payment of prescribed penal fee notified from time to time for late registration. After the SIXTH working day, the Dean of the Institution may permit the student to register with in next SIX working days on genuine grounds and on payment of additional late fee notified from time to time.

9.1.3 The attendance shall be counted from the date of commencement of the semester, irrespective of the date of registration. In case of newly admitted students, attendance shall be calculated from the date of registration.

9.1.4 Any student failing to register for subsequent semester within the prescribed time shall be deemed to have discontinued during that semester. However, student shall provide necessary documentary evidence to the Dean along with representation for discontinuation and by producing NO-DUES CERTIFICATE from the Hostel, Library, Accounts section, Sports section, Stores Section and the Respective Department.

9.1.5 Students shall clear all the dues to the Hostel(s), Library, Accounts section, Sports section, Stores Section and the Respective Departments be for eregistration of every semester.

A student may be permitted to add an approved course after the registration, provided the total number of credits is within the prescribed limit.

9.1.6 Adding of the courses should be done with the written permission of the

PG Coordinator within **15** working days from the date of commencement of the semester.

9.1.7 A student will be permitted to drop a course upto a period of FOUR weeks from the date of commencement of the semester on the recommendation of the PG Coordinator and the permission of the Dean of the Institution.

9.1.8 Master's. students submitting thesis after completion of FOUR semesters, shall register specifically for thesis submission by paying the prescribed fee as notified from time to time.

9.2 RE-REGISTRATION

A student who discontinues for a semester with prior permission of the institution/University can re-register during any subsequent semester not exceeding the limit of EIGHT semesters from the date of admission by paying the prescribed re-registration fee as notified from time to time along with other fees within the prescribed time limit

9.3 RE-ADMISSION

The students who fail to complete their degree programme within the prescribed maximum of EIGHT semesters will not be eligible to get their degree. However, such students can seek re-admission with the approval of the University of Mysore to the same degree programme, by following the normal admission procedure by paying the requisite fee of the Institution/University of Mysore as notified from time to time. Such students will get the benefit of transfer of credits and will be able to complete their pending requirements to get the degree.

9.4 TRANSFER OF CREDITS INRESPECT OF MASTER'S DEGREE STUDENTS.

If a Master's degree student, after getting admission in a particular discipline has successfully completed the supporting and common courses and subsequently joins for Master's degree in a different discipline, is eligible to get the transfer of credits of the supporting and common courses, with grade to which the student gets fresh admission provided the student has completed the course with grade point average of 7.00 and above out of 10.00. However the duration of the master's degree would be counted starting from the date of admission to the new degree programme. Further, "Transfer of Credits" earned from previous admission shall be mentioned in the transcript.

10. FEE

A student who enrolls for Post Graduate programme shall be required to pay the prescribed fee that would be notified from time to time by the Institution and the University of Mysore and announced at the beginning of each academic year.

TUITION AND OTHER FEE ONCE PAID WILL NOT BE REFUNDED.

10.1 Fee for second and subsequent semesters shall be as prescribed by the Institution and the University of Mysore time to time.

10.2 Caution money is refundable on successful completion of the degree programme for which a candidate is admitted or if admission is cancelled. The students can claim the caution money after furnishing the "No dues" certificate from all the concerned within SIX months after completion of the degree programme or cancellation of the admission.

10.3 Miscellaneous and other Fee for University enrolment, certificates, re-registration, convocation, thesis submission *etc*., shall be paid as prescribed by the Institution/University from time to time and is not liable to be refunded.

11. CREDIT REQUIREMENT FOR MASTER'S PROGRAMME

As a National Agenda, Indian Council of Agriculture Research, New Delhi, in its wisdom has developed very detailed structure of course work for Master's degree programmes in various disciplines related to Agriculture. At the SIIASHT, Master's programmes are therefore, designed to be fully in tune with the National Agenda. The details of course and credit requirements for the Master's programmes at the SIIASHT are as follows.

Table 11.1 DISTRIBUTION OF COURSE CREDIT

REQUIREMENTS FOR MASTER'S PROGRAMMES:

Sl. No.	Course Type	No. of Credits
1	Major Courses	20
2	Minor Courses	08
3	Supporting Courses	06
4	Common Courses	05
5	Seminar	02
6	Qualifying Examination	02
7	Research	27
	Total	**70**

11.1 MAJOR COURSE :

Major courses are the courses of the respective Departments in which a master's Student is enrolled. These are considered as Core and Compulsory courses as decided by the Department. A minimum of 20 credits of Major courses should be completed by the student to be eligible to acquire the Degree.

11.2 MINOR COURSES:

Minor course is from the subject closely related to a Major Subject and a student shall be permitted to register only ONE course from the parent discipline to meet the credit requirement of Minor Courses. Rest of the credit requirement can be chosen from other disciplines or the listed supporting courses.

11.3 SUPPORTING COURSES:

Supporting courses are not related to the major subjects. It could be any subject considered relevant for student's research work are necessary for building his/her overall competence.

Table 11.2 THE FOLLOWING COURSES MAY BE OPTED UNDER THE SUPPORTING COURSES

Code	Course title	Credits
AST 501	Mathematics for applied sciences	2+0
AST 502	Statistical methods for applied sciences	3+1
AST 511	Experimental designs	2+1
AST 512	Basic sampling techniques	2+1
AST 521	Applied regression analysis	2+1
AST 522	Data analysis using statistical packages	2+1
MCA 501	Computers fundamentals and programming	2+1
MCA 502	Computer organization and architecture	2+0
MCA 511	Introduction to communication technologies, computer networking and internet	1+1
MCA 512	Information technology in agriculture	2+0
BCM 501	Basic biochemistry	3+1
BCM 505	Techniques in biochemistry	2+2

11.4. Common Courses :

The following courses of one credit each will be offered to all the students undergoing master's degree programme which can be combination of online and offline as identified by the institution.

Table: 11.3 Common courses for Master's Degree progamme

Sl. No.	Course Code	Course Title	Credit Hours
1	CMC501	Library And Information Services	0+1
2	CMC502	Technical Writing and communication skills	0+1
3	CMC503	Intellectual Property and its Management in Agriculture	1+0
4	CMC504	Basic Concepts in Laboratory Techniques	0+1
5	CMC505	Agricultural Research, Ethics and Rural Development Programmes	1+0

11.5 ADDITIONAL COURSES

Based on the specific requirement related to the research topic of a student, the Advisory committee can recommend ONE or TWO additional courses. The additional courses can be of any department being offered at the SIIASHT. Course load of not exceeding THREE credit hours is permitted to be registered under additional courses that are approved by the advisory committee. However, these courses are considered as non-load courses and are not counted for calculation of CGPA/OGPA, but he/she has to undergo regular evaluation process.

12. PERMISSIBLE WORK LOAD

A Master's postgraduate student may register up to a maximum of **23** credit hours in a semester (excluding non-credit courses) on the recommendation of the Major Advisor / PG Coordinator.

Seminars can only be registered during the SECOND year with a maximum of ONE credit per semester.

12.1 DISTRIBUTION OF COURSES BY SEMESTER

At the SIIASHT, Schedule of course loads for all the FOUR semesters of a master's degree programme will be decided by the respective department /institution.

13. ATTENDANCE

The students are required to attend a minimum of **80** percent of the total number of lectures and practicals in each course. If a student falls short of the required attendance to an extent of TEN percent or less in any given course, the shortage may be condoned by the Dean on the recommendation of the course teacher and the PG Coordinator, on the condition that the shortage was due to unavoidable circumstances. Further, such a condonement of the attendance entails penal fee for each course separately to be paid by the student notified from time to time.

Attendance should be credited to the students who represent the University/ College in sports/cultural/literary events, etc., on recommendation of the PG Coordinator with the approval of the Dean, by providing documentary evidence.

13.1 The grade point of a student who does not meet the attendance requirement in a course (including Seminar and Research) shall be indicated as "SA" (SA-Shortage of Attendance). Such students have to re-register and complete the concerned course in subsequent semester AS AND WHEN IT IS OFFERED.

13.2 All Post graduate students enrolled are expected to sign every working day of the Institution in the prescribed Departmental Attendance Register. Those students who have registered for research and conducting their research in an institution or organization other than SIIASHT shall submit a document of attendance on monthly basis from the Major Advisor or Co-Advisor so designated of the respective Orgnisation/Institution.

14. ADVISORY COMMITTEE

An advisory committee will be constituted for every PG student with Major Advisor as the Chairperson, who is a recognized PG teacher in the concerned discipline.

A Major Advisor can be from the Sampoorna International Institute of Agri. Science and Horticultural Technology or from any other institution or Organisation affiliated to the University of Mysore or other State or National level Educational/Research Institution or an Organisation concerned to Agriculture and allied fields.

14.1 If a Major Advisor is from an institution other than the SIIASHT, then a Co-Advisor is appointed from the SIIASHT, who would take the responsibility of the student research and other academic activities at the Institution level.

Alternatively, Major Advisor can be from the SIIASHT and a Co-Advisor can be from the Institution /organization where the student would be permitted to conduct the research.

14.2 The Advisory Committee of a Master's degree student shall consist of three members among whom two members including the Chairperson are from major discipline and one from the supporting discipline.If the Major Advisor is not from the SIIASHT, then the committee would be of four members including the Co-Advisor.

Further, if the Major Advisor feels the need for an additional member, it can be permitted limiting the number of the committee to four members.

14.3 The PG Coordinator shall submit the proposal for the constitution of Advisory Committee (Form–1) of the student to the Dean of the institution for approval. This

shall be completed before the closure of the first semester.

14.4 The Major Advisor shall submit the Plan of Work and Programme of Research (Form-2) as approved by the advisory committee to the Dean through PG Coordinator for approval before the end of the second semester.

All the members shall compulsorily attend the Advisory Committee meetings. However, under unavoidable circumstances one of the members other than the Chairperson may be absent.

15. QUALIFICATION OF THE MAJOR ADVISOR

A faculty member, with a Ph.D. in the concerned subject or with an M.Sc. (Agri.) degree and FOUR years of Teaching/ Research/ and /or Extension is eligible to serve as Major Advisor.

Similarly, any member of the faculty of respective department can serve as the member of the Advisory Committee.

15.1 EXAMINATION AND EVALUATION

Teachers shall be responsible for judging and grading the students' performance in each of the courses registered by the student through a system of examination.

15.1.1 The performance of the student in a course shall be graded on a ten-point scale up to three decimal points.

15.1.2 A student obtaining a grade point of lessthan 6.00 shall be declared as 'Failed' (F) in that course. A student who obtains 'F' or 'SA' grade in courses shall repeat that course when it is offered again by paying prescribed fee for re-registration as notified by the institution from time to time.

15.1.3 In the event of a student getting an 'F' or 'SA' grade in a particular non-core course (non-Major), he may be permitted by the Dean of the Institution on the advice of the Advisory Committee to register for an alternative course to facilitate the student's chances of timely completion of the degree programme. However, such alternative courses may be limited to a maximum of two non-major courses during the entire degree programme.

For computing the GPA and CGPA, "F" or "SA" grades shall be considered as zero.

In each course, total marks shall be a maximum of 100 marks for the purpose of grading.

Table: 15.1 Shows the actual maximum marks for the conduct of the examinations would be as indicated below.

Particulars	Courses with Theory and Practical Component Marks	Courses with only Theory Component Marks	Courses with only Practical Component Marks
I Examination (C1)	15	15	15
II Examination (C2)	15	15	15
Final Examination(C3)	70	70	70
Practical Examination, Practical Records, Assignments, *etc.*(C3)	70		-
Total	**170**	**100**	**100**

15.1.4 Both C1 and C2 Components are Internal Examinations that will be conducted by the course teacher and monitored by the PG Coordinator. The Final Theory Component (C3) would be an External Examination to be conducted by the University of Mysore and strictly monitored by the University of Mysore, Mysuru. Practical examination would be conducted by the course teacher with an external examiner nominated by the PG Coordinator within the Institution and the examination would be monitored by the PG Coordinator.

15.2 Question paper pattern

The pattern of Final written examination will be as indicated below:
Part A – Each paper consists of 20 MCQs of one mark each
Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions

15.3 Evaluation of Internals

15.3.1 Courses with both Theory and Practical Components:

This will be based on test, assignment, presentation. The first component of C1 conducted during 1st half of the semester, the first 50% of the syllabus (Unit 1 & unit 2) will be completed and the second component C2 during second half of the semester the remaining units (unit 3 & unit 4) of the syllabus will be completed, both C1 and C2 will have the both L + P courses.

15.3.1.1 The distribution of marks for both component C1 & C2 are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (2)

C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)

C2 = (3) + (4)

15.3.1.2 Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

15.3.1.3 Practical Examination will be for 70 marks that is split as follows:
Actual Practical Examination that includes written component: 50.00 marks
Practical Record: 10.00 and
Assignment/Viva: 10.00

15.3.1.4 The Final External theory exam and the practical exam marks is computed as follows
Let L = no. of credit hours for theory
P = no. of credits hours for practical
If X is the marks obtained by a student in theory exam and
Y is the marks obtained by the same student in practical examination, then the marks computed, M would be
$M = (L * X + P * Y)/ (L + P)$

Example for calculation of GPA for a student with both theory and Practical components.
Let L= 2 credits and X = 55
P = 1 credit and Y = 65
Then, M = ((2 * 55) + (1 * 65)) / (2 + 1) = (110 + 65)/3= 175/3 = 58.33 that would be rounded of to 58.00 marks.
If the student, in addition, has secured 7 and 9 marks in C1 and C2 respectively, then the total marks would be = 58.00 + 7.00 + 9.00 = 74.00

Therefore, the student will have a GPA of 7.4 for the specific course.

15.3.2 Courses with both only Theory Component P=0:

The distribution of marks for both component C1 & C2 in courses with only theory are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ----(2)
C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)
C2 = (3) + (4)
Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

The total adds up to 100.00 marks.

15.3.3 Courses with both only Practical Component L=0:

The distribution of marks for both component C1 & C2 in courses with only practical are as follows:

Conduct of an experiment or written exam:10.00 ------- (1)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(2)
C1 = (1) + (2)

Conduct of an experiment or written exam:10.00 ------- (3)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(4)
C2 = (3) + (4)

Final Component assessment C3 examination that may include written component also: 50.00 marks.

Practical Record: 10.00 and
Assignment/Viva: 10.00
The total adds up to 100.00 marks.

15.4 The schedule of examinations in each course shall be notified by the respective PG Coordinator for the internal examinations. The schedule for the Final theory examinations will be by the University of Mysore. The first Component in each course will be conducted between 7^{th} and 8^{th} week and the second examination between 13^{th} and 14^{th} week. Practical examinations will be conducted during the last week of instructional days. The final theory examination will be conducted after 110 instructional days but with in the next 10 working days.

15.5 The student shall complete all the approved courses with an Overall Grade Point Average (OGPA) of not less than 7.00 out of 10.00 to be eligible for the award of the master's degree within the residential period.

15.6 In case a student fails to secure the minimum OGPA, the student will be permitted to repeat those courses in which the student has secured a grade point below 7.00 in Masters' degree, provided he/she registers the course by paying the prescribed fee notified by the institution from time to time. The grade point of the course repeated shall be considered for computing the OGPA.

15.7 Missed examination.

A student representing the College / University in sports / cultural / literary activities etc., will be provided the attendance and examination which the student has missed with the approval of the PG Coordinator and the Dean of the Institution. Such students are exempted from missed examination fees.

15.7.1 Students who miss any internal examination in a course due to hospitalization/death of parent/ own marriage/ attending interview/attending court cases, may be permitted by the PG Coordinator to appear for the missed examination on their commendation of the course teacher by paying the prescribed fee notified by the institution from time to time for each of the missed examination. Further, a student is eligible to appear for only one missed examination in a course in a semester.

15.7.2 The missed examination shall be conducted within 15 days from the date of missing the internal examination. The course teacher shall notify the date of missed examination and the students failing to take the missed examination on the notified date by paying a prescribed notified fees and time will have no further claim for another examination. Whereas the regulations prescribed for missed examination in a course shall not be applicable for final examination of each course

15.7.3 In case of missing an examination on medical grounds, a certificate from a government Medical Practitioner should be produced. Students staying at the campus in the College Hostel should produce the medical certificate issued from the designated Medical Officer.

A student may appeal to the Dean for redressal of grievances relating to the appearance for the missed examination.

The regulations prescribed for missed examination shall not be applicable for comprehensive written qualifying examination conducted by the university of Mysore in Masters' programmes.

16. SUBMISSION OF GRADE REPORTS

16.1 The evaluated answer papers of internal examinations shall be returned to the students only after the finalization of the grades by the University.

16.2 A student should fulfill all the requirements for the completion of course, failing which the grade point will be finalized based on the marks secured.

The PG Coordinator shall evaluate the Attendance percentage of all the students in the different Courses and send the same to the examination section of the University of Mysore after notifying the same to the respective students to determine the eligibility to take the Final Examination in each course. The Attendance Report and internal examination marks should reach the Examination section of the University of Mysore on or within the scheduled date as announced in the University notification.

16.3 A Grade point card of a student will be prepared for each semester based on the marks secured by the student by the University of Mysore and Transmitted to the College for further documentation and onward transmission to the student.

17. QUALIFYING EXAMINATION

17.1 A student is eligible to register for qualifying examination on completion of 75 percent of approved courses including 20 credits of major courses, excluding research and seminar. Separate Registration for qualifying examination should be completed by paying the prescribed fees within eight weeks from the commencement of the semester with the approval from the PG Coordinator.

17.2 The qualifying examination will carry TWO credits and shall consist of two parts:

17.2.1 Written examination for 150 marks covering 20 credits of core courses. 75 marks each for PAPER I and PAPER II Paper patterns:

Part A – Each paper consists of 25 MCQs of one mark each and the question paper shall not be returned.

Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions
Courses for Paper I and Paper II will be notified by the PG Coordinator.
Each paper will be conducted for two and half hours.

17.2.2 *Viva-voce* for 50marks.

The University of Mysore shall conduct the written qualifying examination. Three sets of questions for each course will be developed and submitted by the individual course teachers to the PG Coordinator. Who in turn will develop a set of three papers each for the two examinations to be submitted to the University. The Chairman, BOS will choose one each finally for the two written examinations. Alternatively, the University will nominate an External Examiner for setting the question papers and evaluation of the answer scripts.

17.2.2.1 The *viva-voce* examination shall be conducted by the Advisor Committee with an external examiner designated by the University of Mysore. In a day *viva-voce* examination for a maximum of six students may be scheduled.

17.2.2.2 The external examiners shall be specialists in the major field from outside the Institution. The PG Coordinator will be the Chairperson of the Examination Committee and shall be responsible for communicating the results of the examination to the Dean of the Institution, who in turn will pass on the Results to the University of Mysore.

Not more than one member, other than the Chairperson and the External examiner, could be absent for the qualifying examination.

17.2.2.3 In special and emergency circumstances, when the Chairperson is unable to be present and conduct the qualifying examination, the Dean may designate, a Senior Professor to officiate as Chairperson to conduct the qualifying examination.

17.2.2.4 In special and emergency circumstances when not more than two members of the Advisory Committee are unable to be present and conduct the qualifying examination due to their hospitalization/out of head-quarter on official duty/ on long leave, the Dean may designate one of the faculty members to officiate as a member to conduct the qualifying examination.

17.2.2.5 The minimum requirement for a pass in the qualifying examination shall be a Grade Point of 7.000 (aggregate of written and viva voce examinations) with the stipulation that the student should obtain a minimum of 60 per cent in the written part of the qualifying examination to be eligible for *viva-voce* examination.

17.2.2.6 The qualifying examination will be conducted only once in an academic year. However, as a special case, the students who abstained or failed in the qualifying examination shall re-register for the same in the subsequent semester by paying the prescribed penal fee on the recommendation of the Major Advisor and PG Coordinator with the approval of the University of Mysore.

17.2.2.7 When a master's student has passed the qualifying examination; the student may be admitted to the candidacy of the degree. Formal intimation to this effect would be communicated to the student, Major Advisor and PG Coordinator by the University of Mysore on the basis of the recommendation of the Dean, SIIASHT.

18. SEMINARS AND COLLOQUIA

18.1 A PG teacher in the Institution will be designated as Teacher in charge of seminar course by the PG Coordinator. The student shall submit the topic of the seminar to the seminar teacher for approval. This minor teacher shall notify the topics and the schedule of the seminars within two weeks of the commencement of the semester.

18.2 The post graduate students stationed outside the SIIASHT for Research purpose who are not in a position to attend the seminars in the respective Departments, their participation in the seminars conducted in the respective institutions may be considered for purposes of counting the Attendance, if a regular seminar series exists in the concerned institution/organisation. If not, then the student has to mandatorily attend the seminars in the respective department. These conditions not with standing, the students should attend a minimum of 50 percent of seminars during the Semester in the Department and should give their own seminars in the respective Department. However, overall, 80 % attendance is must for completion of the Seminar course.

18.3 A student shall be permitted to register for seminar from second year of their admission and they will not be permitted to register for more than one seminar in a semester.

Table : 18.1 Evaluation of the seminar shall bed one by the teacher in-charge of the seminar and one additional faculty member as here under:

Sl. No	Description	Marks
1	Synopsis of the Seminar Topic	10.00
2	Presentation including Language, Introduction, Style and Clarity, Sequence and Organization, Topic Coverage	40.00
3	Effective use of Audio-Visual Aids	5.00
4	Time Management	5.00
5	Response to Questions during discussion	10.00
6	Report	30.00
	Total	100.00

In addition to fulfilling the seminar course requirement, each student shall present TWO colloquia related to the research topic first one prior to the submission of Form-2 and the second one after completion of research before circulation of thesis among the members of the advisory committee.

19. RESEARCH

19.1 The credits set aside for Research work for Post graduate Programme is distributed to different semesters. No student shall be permitted to register for Research credits until the approval of Plan of Work and Programme of Research (Form-2).

19.2 If the student does not submit the thesis during the last semester, 'IC' (Incomplete) grade shall be awarded for these research credits. The student shall re-register for these credits within the stipulated period for submission of the thesis.

19.3 Registration for submission of thesis beyond the prescribed period (four semesters for M.Sc.) may be done at any time during the stipulated time of (eight semesters from the date of admission of the student). The research credits registered for the PG degree programmes shall be graded as satisfactory/ not satisfactory after the submission of the progress report to the PG Co-Ordinator through the Major Advisor

20. THESIS SUBMISSION AND FINAL *VIVA-VOCE*

20.1 The student shall submit the thesis as per the guidelines issued by the Institution for **evaluation by the external examiner.**

20.2 Plagiarism

The student who submits the thesis for external has to provide the certificate of plagiarism issued by the University from time to time. The regulations issued through UGC notification on University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations Dtd. 23.07.2018 is applicable to the faculty and students regarding plagiarism. It is mandatory that each thesis submitted be verified for plagiarism and a certificate duly endorsed by the Major Advisor is to be provided by all the master's students.

20.3 The Masters' degree students before the submission of the thesis for external evaluation should compulsorily complete the poster presentation either at the PG Conference of the Institute or at any other scientific conference.

20.4 The thesis submitted in partial fulfilment of the Master's Degree shall be examined by the Advisory Committee and further evaluated by an External Examiner nominated by the Registrar (Evaluation), University of Mysore. The External Examiner shall be appointed by the Registrar (Evaluation) on the recommendation of the Major Advisor through the PG Coordinator, from a panel of three names in India but outside the University.

However, the Registrar (Evaluation) has the discretion of selecting an External Examiner from outside the Panel of specialists suggested. The External Examiner shalls end there port in the prescribed format along with the thesis to the Dean, SIIASHT with a copy of the report to the Registrar (Evaluation).

20.5 If the external examiner does not recommend the thesis for acceptance, the Registrar (Evaluation) may refer the thesis to the second examiner for evaluation on payment of a penal fee. If the second examiner recommends the thesis, the recommendation will be accepted. If the second examiner also does not recommend the thesis, the student shall have to re-write the thesis and re-submit the same after a lapse of one semester, by re-registering for thesis submission. If the thesis of the student is not accepted for the third time also, that thesis cannot be resubmitted. Under such circumstances, the student has to repeat the entire Research credits and work on a different thesis problem.

20.6 The final *viva-voce* examination will be held by the Advisory Committee within one month after the receipt of permission letter from the University to the PG Coordinator. However, under special circumstances the student is allowed to take final *viva-voce* within six months on payment of prescribed penal fee as prescribed by the Institution.

20.7 The Major Advisor shall be the Chairperson of the examination Committee. A designated teacher from within in the Institution will serve as the External Evaluator for the Final Viva-voce examination. External Evaluator for the Final Viva-voce would be appointed by the Dean, SIIASHT, on the recommendations of the PG Coordinator. Under special circumstances when the Chairperson of the Advisory Committee is unable to present and conduct the final *viva-voce*, the Co-Advisor or one of the Advisory Committee Members of the concerned Department can officiate as Chairperson on the recommendation of the PG Coordinator with the approval of the Dean. Further, when more than one member of the Advisory Committee are unable to be present and conduct the final *viva-voce* examination, due to their hospitalization/out of headquarters on official duty / on long leave, the PG Coordinator may designate any PG teacher to officiate on the request of the Major Advisor and HOD, as member to conduct the final *viva-voce*.

20.8 The Chairperson shall send the recommendations of the Advisory Committee to the PG Coordinator. Who in turn will transmit the same to the Registrar (Evaluation) of the University of Mysore, through the Chairman BOS, for the award of the Degree. All the concerned Forms ONE to SIX, will have been completed and submitted by the Institution to the Registrar (Evaluation), University of Mysore by this time, for the student to be eligible to get the Provisional degree Certificate.

20.9 The Thesis copies of the PG student should be type written and bound as specified by the University from time to time. Each student should submit three copies of the thesis and three CDs. Out of three copies of the thesis one each will be submitted to the Library, Department and to the University of Mysore. One CD will be placed in the library, and another will be submitted to the University of Mysore. A CD will also be submitted to the Major Advisor.

20.10 Incase of ICAR/Donor sponsored scholarship holders, a fourth copy of the Thesis along with CD should be submitted to the PG Coordinator for forwarding to ICAR/Donors.

20.11 The Thesis submitted by a student shall constitute the property of the Institution. Whenever an extract from the Thesis is published a foot note shall always have to be given indicating that the Thesis has been submitted for the post-graduate degree of the SIIASHT under the University of Mysore.

Copies of the Thesis deposited in the University Library or in the Departmental Libraries shall not be issued on loan, nor would these be available for reference, for a period of one year from the date of submission.

21. Regulations governing the conduct of Examinations and Prevention of Malpractices among students.

21.1 REGULATIONS GOVERNING THE CONDUCT OF EXAMINATIONS

21.1.1 The scheme of evaluation in each course shall be periodically notified by the University of Mysore.

21.1.2 It is the responsibility of the concerned course teacher to prepare the question paper and safe guard the secrecy.

21.1.3 The course teacher should ensure the prevention of malpractices in examinations. No student should be allowed to enter the examination hall later than 10 min. after the commencement of the exam. No electronic gadget will be allowed inside the examination hall, except when the course teacher permits.

21.1.4 When the teacher notices the student indulging in any malpractice, the teacher shall seize the paper from the student and shall in variably demand a written explanation or statement from the student.

21.1.5 If the student refuses to obey, the fact shall be duly noted and reported in writing to the Dean duly witnessed by another staff member. The teacher shall write remarks on the answer paper and affix the signature and send the candidate out of the hall. Such students shall not be allowed to take further examinations in that course during that semester.

21.1.6 All cases of malpractices should immediately be brought to the notice of the Dean concerned who shall send a report there on to the University authorities for such necessary action as may be deemed fit.

21.1.7 All cases of malpractices referred to the University authorities be examined by a committee set up by the University of Mysore. The decision of the Committee shall be final subject to review by theVice-Chancellor.

The committee may debar the guilty students for a period of one semester.

21.2 REGULATIONS GOVERNING THE PREVENTION OF MALPRACTICES AMONG STUDENTS

21.2.1 The students shall bear in mind that all the examinations under the semester system are University Examinations and should conduct accordingly.

21.2.2 No student shall enter the examination hall with papers, books or notes, electronic gadgets and such other material which might possibly be of assistance.

21.2.3 Any student indulging in malpractices during the examination shall be debarred for a period not less than one semester.

21.2.4. Any candidate found guilty of misconduct of a serious nature in the examination hall shall be debarred for a period of not less than two semesters.

21.2.5 Any candidate found guilty of an offence, shall give a written explanation or statement to the teacher or in-charge of the main examination hall if demanded. If the student refuses to give explanation or statement, student should record in writing for refusal to give such an explanation or statement.

21.2.6 Any candidate, who does not comply with the procedure indicated in the above said rule, may be deemed to have committed an offence shall bear consequent penalty.

21.3 REGULATIONS FOR THE MAINTENANCE OF DISCIPLINE AMONG THE STUDENTS

21.3.1 Every student of the SIIASHT shall conform to the rules of good conduct and respect the authority of the constituted bodies of the Institution and the University.

21.3.2 Every student of the Institution shall have a Student Identification Card with recent photograph affixed and signed by the concerned authority and shall be shown whenever it is demanded.

21.3.3 Students shall do everything possible to protect and make proper use of the Institution property and other public property. Any student who attempts to deface/destroy the Institution or other public property shall be liable for appropriate punishment. In addition, the cost of damage as assessed by the Institution caused by the students shall be recovered from the concerned Student after due examination by the Dean or a designated person by the Dean.

21.3.4 Proper decorum shall be maintained by all the students in the classroom, hostels, library, farms, educational and sports tours, transport vehicles and on & off the Campus of the Institution.

21.3.5 No student shall disturb the normal work of the Institution by disorderly conduct, boisterous behavior and unauthorized assembly.

21.3.6 Ragging in any form in the Institution premises is strictly prohibited. Students found guilty of ragging are liable for disciplinary action.

21.3.7 Every student shall be punctual to the classes. Class Teacher has the right to refuse admission to late-comers in the interest of class discipline.

21.3.8 Absenting to a class or examinations for whatever reason is considered as an act of indiscipline.

21.3.9 No student shall be in a class during the assigned hour unless the student has registered in that course. Students are not permitted to carry mobile phones during the class hours.

21.3.10 Possession or consumption of alcoholic drinks or drunkenness or drug addiction or gambling on the campus is strictly prohibited.

21.3.11 Violation of any one of the above regulations is an act of indiscipline and will be dealt by the Dean/Management or a person appointed by the Dean.

21.3.12 The Dean/Management shall enquire into the act of in discipline of the student(s) and the concerned shall take immediate action such as warning, fine and expulsion from Hostel and suspension from attending the classes for a period not exceeding one semester.

21.3.13 Further, in serious cases, disciplinary proceedings may be instituted through the Disciplinary Committee which can recommend punishment in the form of a warning/expulsion from the college for a semester/year.

21.3.14 Bonafide students will lose all those benefits from the University or from other Institutions with the University approval, if they are found to be involved in any of the acts of indiscipline.

21.3.15 Celebration of festivals on days other than authorized and unruly behaviour on such occasions will be considered as an act of indiscipline.

21.3.16 A student who has been found guilty by the Institution or the Disciplinary Committee and has been fined/suspended/expelled from the College or Hostel, shall not be permitted to hold any office, elected or otherwise, of student associations for a period of two years from the date of completion of the punishment.

21.3.17 If a student is taken into police custody on a criminal or other complaint for a period of 24hours or more, the student shall be deemed to have been suspended from the College for a period of one month from the date on which the student was taken into police custody without instituting an enquiry.

The decision of the Dean under all these Regulations shall be final.

22. CONVOCATION

22.1 The University shall confer degrees to all the students who complete their degree requirements in all respects in an academic year. However, at the time of taking their transcript and provisional degree certificate, they should fill in the convocation application and pay the prescribed fee and exercise their option whether they will be taking the degree in the Annual Convocation IN PERSON or IN ABSENTIA.

22.2 If a student has applied for a particular Convocation to take the degree 'In person' but fails to attend the Convocation, the student has to apply again by paying the penal fee in addition to the prescribed fee.

22.3 In case of death of a student before taking the degree at the Convocation, the nearest relative can apply for getting the degree at the Convocation. In such cases the University may consider confirming the degree on the candidate and award Gold Medals if any, posthumously.

23. REGULATION RELATING TO THE SCHEME OF HONOURING STUDENTS OF OUTSTANDING MERIT

A Gold Medal for each major subject at Master's. level shall be awarded to the students securing the highest Overall Grade Point Average with not less than 9.00 in the concerned Postgraduate degree together with a certificate of Merit. Two or more students getting the same OGPA will be awarded a Medal and a Certificate of Merit each, provided the OGPA is identical even to the fourth decimal. The Gold Medal and a Certificate of Merit shall be awarded at the time of Convocation. The value of each Gold Medal for each candidate will be the same.

The student shall complete all the formalities required for completion of the Degree programme on or before the last working day of the fourth semester from the date of admission of the student to be eligible to get any Medal.

However, the eligible candidate with the highest OGPA than the minimum requirement prescribed for the award of Gold medal will be issued a "Certificate of Merit".

24. DETERMINING CLASS/DISTINCTION

The following OGPA will be considered as equivalent to the Class/Division mentioned.

OGPA 9.00 & above	First Class with Distinction
OGPA 8.00 to 8.99	First Class
OGPA 7.00 to 7.99	Second Class for master's degree

POST GRADUATE FORMS

FORM 1

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B.Doddi, Maddur

Proposal for Constitution / Re-Constitution of Advisory Committee

The following members are proposed for the Constitution/Re-constitution of Advisory Committee in respect of Mr./Ms._____I.D. No._____admitted to Master's Programme in Entomology/Agronomy/Genetics & Plant Breeding during the year _____. The tentative title of his/her research programme is _____ _____ _____ _____ _____

Name and Designation		Address
1.		
2.		
3.		
4.		
5.		

Signature of the Chairperson

Forwarded to the Dean, SIIASHT in duplicate for approval and onward transmission to the University of Mysore, Mysuru..

Date **Signature PG Co-ordinator**

Forwarded to University of Mysore, Mysuru

Note: The form no. 1 should be submitted on or before twelveth week of the first semester

Date **Dean of SIIASHT**

Submitted for Approval and Notification to the **Registrar (Evaluation), University of Mysore**

Signature Chairman (BOS)

FORM 2

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

Plan of work & Programme of Research approved by the Advisory Committee

Date.....

The Advisory committee of Ms. /Mr.....
ID No. ..... admitted to Master's programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding met on ..... at ..... in ..... campus.

(*)1. The plan of work was considered.

2. The programme of research was considered.

3. The plan of work and programme of research were reviewed and the changes suggested are attached herewith.

4. Other issues considered.

Advisory Committee

	Name and Designation	**Signature**
1.	..... (Chairperson)	.....
2.	..... (Member)	.....
3.	..... (Member)	.....
4.	..... (Member)	.....
5.	..... (Member)	.....

Forwarded to the Dean, SIIASHT for information. And documentation and onward transmission to the University ofMysore.

Signature of PG Co- ordinator **Signature**
Major Advisor
Date .....

(*) Please strike off items not relevant

Plan of Work

5. Details of courses to be studied:

I Semester of the year .....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major Courses			Minor courses	
				Supporting Courses	
				Common Courses	
				Additional Courses	
	Total				
				Total	

Total credits.....

II Semester of the year.....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major courses			Minor courses	
				Supporting Courses	
				Common Courses	
	Total			Additional Courses	
				Total	

Total credits.....

6. Total credits proposed for registration:

Sl. No.	Course Type	No. of Credits	
		Min. Required credits hours for Master's Programme	No. of credits hours completed
1	Major Courses	20	
2	Minor Courses	08	
3	Supporting Courses	06	
4	Common Courses	05	
5	Seminar	02	
6	Qualifying Examination	02	
7	Research	27	
	Total	**70**	

7. Tentative title of the research programme:

8. Additional information, if any:

Signature of Student **Signature of Chairperson**

Forwarded to the Dean, SIIASHT for approval.

Date..... **Signature of the PG Co- ordinator**

Programme of Research

1. Title of the research programme /topic:

2. Objectives:

3. Brief review of work:

4. Detailed programme of work:

5. Collaboration with other Departments /Institutions / Organisations and Fellow Scientists:

6. Salient features of the research work:

7. References:

Signature of the Student **Signature of theChairperson**

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean,
SIIASHT,
MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Approved

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 3

Report of the Examining Committee on the performance of the student in Qualifying Examination

Master's. degree programme majoring in ..... met on ..... at the Institute.

The qualifying examination, written as well as oral was conducted by the committee members. He/ She has passed / failed in the Examination.

He/ She has secured ..... marks out of..150 . in written and ..... marks out of .50 in oral examination. The grade point for qualifying examination is ..... out of..10.000.

Member's Present	**Signature**
1. ..... (Chairperson)	.....
2. ..... (Member)	.....
3. ..... (Member)	.....
4. ..... (Member)	.....
5. ..... (Member)	.....
6. ..... (Member)	.....

Members who could not attend

1. .....
2. .....

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 4

Proposal for Nomination of External Examiners for Thesis Evaluation

1. Ms. /Mr. ..... ID No.-..... admitted to M.Sc. (Agri.) degree programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding has completed the course requirements and has passed in the qualifying examination.
2. Her/ his grade point average is .....
3. The title of Her/ his thesis is .....
4. Key words in thesis: .....
5. A panel of names of external examiners, with their addresses, land line and mobile phone numbers and E-mail ID, for evaluation of thesis is furnished here under (3 members for Master's degree programme).

1. .....

2. .....

3. .....

Signature of PG Co-ordinator **Signature of the Chairperson**

Date.....

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for approval.in duplicate for information and needful.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature of Chairman (BOS)

1) Dr. .....is approved.

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 5

Details of Courses and Submission of Thesis

1. Name of the student :
2. I.D. No :
3. Year of Admission :
4. Degree Programme :
5. Major Subject :
6. Thesis entitled : .....
   .....
   .....
7. List of Courses :

Course No.	Title of the Course / Seminar	Credit Hours	Grade Points Obtained
	A. Major courses completed		
	B. Minor courses completed		
	C. Supporting Courses		
	D. Common Courses		
	E. Qualifying Examination		
	F. Seminar completed		
	G. Additional Courses if any		

C. Colloquia presented

Sl. No.	Title of the Colloquium	Date of Presentation
1		
2		

8. Has the Plan of Work and Programme of Research been considered by the Advisory Committee and approved by **Registrar (Evaluation), University of Mysore**
9. Has changes, if any, in the Plan of Work and Programme of Research been recommended by the Advisory Committee and revised approval of **Registrar (Evaluation), University of Mysore** obtained:
10. Furnish details, if the Research topic has been changed.
    Topic of Research: .....
    Revised Topic of Research: .....
11. Has the student completed the total number of credits (Furnish the details).

No. of Credits registered	No. of Credits completed	Semester

12. Has the student submitted her / his thesis within the stipulated period of the PG programme.

Date of Registration for Thesis submission	Date of Submission of Thesis

13. Has the candidacy of the student been declared:

Signature of the Student

.

CERTIFICATE

Certified that the above requirements have been checked with reference to the student file and found correct.

Certified that the student has fulfilled all the requirements of credits for submission of thesis for External Evaluation.

Signature of the PG Co-ordinator **Signature of the Chairperson**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for onward transmission of the thesis submitted for evaluation by the External Evaluator.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

Signature
Chairman (BOS)

Transmitted under intimation to the Dean, SIIASHT,

Registrar (Evaluation)

FORM 6

Report of the Final Viva-Voce Examination

Date .....

The Examining Committee in respect of Ms., ID No. admitted to M.Sc. (Agri.) degree programme during the year and majoring in **Entomology** met on at **the SIIASHT.** .

The committee considered the report(s) of the External Examiner/s and..... on the thesis. The examiner hasrecommended the thesis for acceptance.

The final Viva-Voce examination was conducted by the Committee Members. The performance of the candidate was .....

Signature of the External Examiner

The committee recommends / does not recommend the approval of the thesis entitled **".....".**

Member's Present **Signature**

1. . (Chairperson) .....
2. .....(Member) .....

Members who could not attend

1. .....
2. .....

a) One hard copy and a soft copy of the thesis have been submitted to the Librarian, SIIASHT, Channapattana and a copy of the receipt is attached herewith.
b) One soft copy of the thesis has been submitted to the Major Advisor, SIIASHT, Channapattana.
c) One copy of the thesis submitted herewith to the Chairman, BOS for onward transmission to the University Library
d) The master's student has presented his / her thesis poster on

Date- **Signature of the Chairperson**

Forwarded to the Dean, SIIASHT, Channapattana in duplicate for further needful.

Date- **Signature of the PG Co-ordinator**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for with a request to issue the notification.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

SignatureChairman (BOS)

Notification Issued (To be issued within a week of the receipt of the request)

Registrar (Evaluation)
University of Mysore

Semester wise Distribution of Courses for M.Sc. (Agri.) in ENTOMOLOGY

I YEAR					
SEMESTER - I					
Sl. No.	**Code**	**Course Title**	**Type**	**Credits**	**Total Credits**
1	CMC 501	Library and Information Services	Common	1	
2	CMC 502	Technical Writing and Communications Skills	Common	1	
3	CMC 504	Basic Concepts in Laboratory Techniques	Common	1	
Total Credits					**3**
4	AST 502	Statistical methods for applied sciences	Supporting	4	
Total Credits					**4**
5	ENT 501	Insect Morphology	Major	3	
6	ENT 502	Insect Anatomy and Physiology	Major	3	
7	ENT 504	Insect ecology	Major	3	
8	ENT 508	Concepts of integrated pest management	Major	2	
Total Credits					**11**
9	MCA 512	Information technology in agriculture	Minor	2	
	Total Credits				**2**
TOTAL CREDITS FOR I SEMESTER					**20**
SEMESTER – II					
1	CMC 503	Intellectual Property and its management in Agriculture	Common	1	
2	CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	
	Total Credits				**2**
3	BCM 501	Basic biochemistry	Supporting	4	
Total Credits					**4**
4	ENT 503	Insect taxonomy	Major	3	
5	ENT 506	Toxicology of insecticides	Major	3	
6	ENT 510	Pests of Horticultural and Plantation crops	Major	3	
Total Credits					**9**
7	ENT 509	Pests of field crops	Minor	3	
8	AST 511	Experimental designs	Minor	3	
Total Credits					**6**
TOTAL CREDITS FOR II SEMESTER					**21**

II YEAR					
SEMESTER - III					
1	ENT 581	Qualifying Examination	QE	2	
2	ENT 591	Master's seminar I	Seminar	1	
3	ENT 599	Master's research	Research	13	
TOTAL CREDITS FOR III SEMESTER					**16**
SEMESTER - IV					
1	GPB 592	Master's seminar II	Seminar	1	
2	GPB 599	Master's research	Research	14	
TOTAL CREDITS FOR IV SEMESTER					**15**

SUMMARY OF CREDITS DISTRIBUTION FOR THE FOUR SEMESTERS

Sl. No.	Course Type	I Semester	II Semester	III Semester	IV Semester	Total No. of Credits
1	**Major Courses**	11	09			**20**
2	**Minor Courses**	02	06			**08**
3	**Supporting Courses**	04	04			**08**
4	**Common Courses**	03	02			**05**
5	**Seminar**	-	-	01	01	**02**
6	**Qualifying Examination**	-	-	02	-	**02**
7	**Research**	-	-	13	14	**27**
	Total	**20**	**21**	**16**	**15**	**72**

COMMON COURSES FOR M. Sc. (AGRI.) IN DIFFERENT DISCIPLINES

To be in tune with the BSMA norms of the ICAR, New Delhi, the following courses (one credit each) will be offered to all students undergoing Master's degree programme at SIIASHT, Maddur

Code	Course Title	Credits	Credit Pattern	Credit Value
CMC 501	Library and Information Services	1	0+1	1
CMC 502	Technical Writing and Communications Skills	1	0+1	1
CMC 503	Intellectual Property and its management in Agriculture	1	1+0	1
CMC 504	Basic Concepts in Laboratory Techniques	1	0+1	1
CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	1	1+0	1

Some of these courses are also available in the form of e-courses. The students are allowed to register for these courses/similar courses on these aspects, if available online on SWAYAM or any other platform with the permission of the PG Coordinator under intimation to the Chairman (BOS) and the Registrar (Evaluation).

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 Major Advisor and the PG Coordinator. However, the overall Credit requirement of a minimum of 05 credits through Common Courses are to be met by every Master's student registered at SIIASHT to meet the norms of the BSMA.

SYLLABUS OF COMMON COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

CMC 501 : LIBRARY AND INFORMATION SERVICES (0+1)

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information-Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Richard E. Rubin. 1998. Foundations of Library and Information Science (Paperback)

Kay Ann Cassell and Uma Hiremath, 2006. Reference and Information Services in the 21st Century : An Introduction.

CMC 502: TECHNICAL WRITING AND COMMUNICATIONS SKILLS (0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical Technical Writing –

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

• Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
• Collins' Cobuild English Dictionary. 1995.
• Harper Collins. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed.
• Holt, Rinehart & Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
• James HS. 1994. Handbook for Technical Writing. NTC Business Books.
• Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East- West Press.
• Mohan K. 2005. Speaking English Effectively. MacMillan India.
• Richard WS. 1969. Technical Writing.
• Barnes & Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
• Abhishek. Sethi J &Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
• Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

CMC 503: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Erbisch FH &Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.

- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

CMC 504: BASIC CONCEPTS IN LABORATORY TECHNIQUES (0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
Gabb MH &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

CMC 505: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions;

UNIT II

Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT III

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT IV

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co- operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
- Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
- Singh K.. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

ICAR, New Delhi, as per the norms of the BSMA has suggested the following courses to be offered by various disciplines (The list is only indicative) to meet the requirement of Supporting Courses. It is mandatory that a minimum of Six credits of supporting courses be completed by the Master's degree students in different disciplines. Based on the requirement, some of the following courses have been opted under the supporting courses. The syllabi of these courses are detailed below. At SIIASHT, Maddur, some of these courses are also suggested for Minor courses requirement.

Code	Course Title	Credits	Credit Pattern	Credit Value
AST 501	Mathematics for applied sciences	2	2+0	2
AST 502	Statistical methods for applied sciences	4	3+1	4
AST 511	Experimental designs	3	2+1	3
AST 512	Basic sampling techniques	3	2+1	3
AST 521	Applied regression analysis	3	2+1	3
AST 522	Data analysis using statistical packages	3	2+1	3
MCA 501	Computers fundamentals and programming	3	2+1	3
MCA 502	Computer organization and architecture	2	2+0	2
MCA 511	Introduction to communication technologies, computer networking and internet	2	1+1	2
MCA 512	Information technology in agriculture	2	1+1	2
BCM 501	Basic biochemistry	4	3+1	4
BCM 505	Techniques in biochemistry	4	2+2	4
	TOTAL		**35**	

SYLLABUS OF SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

AST 501: Mathematics for Applied Sciences (2+0)

Aim of the course

This course is meant for students who do not have sufficient background of Mathematics. The students would be exposed to elementary mathematics that would prepare them to study their main courses that involve knowledge of Mathematics. The students would get an exposure to Linear Algebra, differentiation, integration and differential equations etc.

Theory

Unit I

Set theory-set operations, finite and infinite sets, operations of set, function.

Unit II

Vectors and vector spaces, Matrices notations and operations, laws of matrix algebra; transpose and inverse of matrix, Eigen values and Eigen vectors. Determinants -evaluation and properties of determinants, Solutions of Linear Equations.

Unit III

Variables and functions, limits and continuity of specific functions. Differentiation theorems of differentiation, differentiation of logarithmic, trigonometric, exponential and inverse functions, Differentiation of function of a function, derivatives of higher order, partial derivatives. Application of derivatives, determination of points of inflexion, maxima and minima.

Unit IV

Integration, methods of integration, reduction formulae, definite and indefinite integral, Applications of integration in Agriculture, Differential Equations.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Hohn FE. 2013. *Elementary Matrix Algebra*, 3rd Ed., Kindle Edition
• Harville D.A. 1997. *Matrix Algebra from a Statistician's Perspective*. Springer.
• Hohn F.E. 1973. *Elementary Matrix Algebra*. Macmillan.
• Searle S.R. 1982. *Matrix Algebra Useful for Statistics*. John Wiley.
• Stewart J. 2007. *Calculus*. Thompson.
• Thomas G.B. Jr. and Finney R.L. 1996. *Calculus.* 9th Ed. Pearson Edu.

AST 502: Statistical Methods for Applied Sciences (3+1)

Aim of the course

This course is meant for students who do not have sufficient background of Statistical Sciences: Agricultural Statistics Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Theory

Unit I

Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation.

Unit II

Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions.

Unit III

Introduction to theory of estimation and confidence-intervals, Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination, Fitting of quadratic models.

Unit IV

Non-parametric tests – sign, Wilcoxon, Mann-Whitney U-test, Run test for the randomness of a sequence. Median test. Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques, Introduction to Multivariate Analysis, Transformation of Data.

Practical

- Exploratory data analysis, fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal.
- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and Correlation and regression analysis, fitting of Linear and Quadratic Model.
- Non-parametric tests. ANOVA: One way, Two Way, SRS.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Goon A.M, Gupta M.K and Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
• Goon A.M, Gupta M.K. and Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
• Hoel P.G. 1971. *Introduction to Mathematical Statistics*. John Wiley.
• Hogg R.V and Craig T.T. 1978. *Introduction to Mathematical Statistics*. Macmillan.
• Morrison D.F. 1976. *Multivariate Statistical Methods*. McGraw Hill.
• Hogg RV, McKean JW, Craig AT. 2012. *Introduction to Mathematical Statistics* 7th Edition.
• Siegel S, Johan N & Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*. John Wiley.
• Anderson TW. 2009. *An Introduction to Multivariate Statistical Analysis*, 3rd Ed . John Wiley
• http://freestatistics.altervista.org/en/learning.php.
• http://www.statsoft.com/textbook/stathome.html.

AST 511: Experimental Designs (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Agricultural Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

Unit I

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

Unit II

Uniformity trials, size and shape of plots and blocks, Analysis of variance, Completely randomized design, randomized block design and Latin square design.

Unit III

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom. Concept of confounding.

Unit IV

Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined analysis.

Practical

- Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law, Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments,
- Analysis with missing data,
- Split plot and strip plot designs.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG and Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley.
- Dean AM and Voss D. 1999. *Design and Analysis of Experiments*. Springer.
- Montgomery DC. 2012. *Design and Analysis of Experiments*, 8th Ed. John Wiley.
- Federer WT. 1985. *Experimental Designs*. MacMillan.
- Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
- Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*. John Wiley.
- www.drs.icar.gov.in.

AST 512: Basic Sampling Techniques (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

Theory

Unit I

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

Unit II

Simple random sampling with and without replacement, sampling for proportion, determination of sample size, inverse sampling, Stratified sampling.

Unit III

Cluster sampling, Multi-stage sampling, systematic sampling; Introduction to PPS sampling,

Unit IV

Use of auxiliary information at estimation, Ratio product and regression estimators. Double Sampling, sampling and non-sampling errors.

VI. Practical

- Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.;
- Simple random sampling, determination of sample size, inverse sampling, stratified sampling, cluster sampling and systematic sampling;
- Estimation using ratio and regression estimators;
- Estimation using multistage design, double sampling.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG. 1977. *Sampling Techniques*. John Wiley.
- Murthy MN. 1977. *Sampling Theory and Methods*. 2nd Ed. Statistical Publ. Soc., Calcutta.
- Singh D, Singh P and Kumar P. 1982. *Handbook on Sampling Methods*. IASRI Publ.
- Sukhatme PV, Sukhatme BV, Sukhatme S and Asok C. 1984. *Sampling Theory of Surveys with Applications*. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.
- Cochran WG. 2007. *Sampling Techniques*, 3rd Edition. John Wiley & Sons Publication

AST 521: Applied Regression Analysis (2+1)

Aim of the course

This course is meant for students of all disciplines including agricultural and animal sciences. The students would be exposed to the concepts of correlation and regression. Emphasis will be laid on diagnostic measures such as autocorrelation, multi collinearity and heteroscedasticity. This course would prepare students to handle their data for analysis and interpretation.

Theory

Unit I

Introduction to correlation analysis and its measures, Correlation from grouped data, correlation, Rank correlation, Testing of population correlation coefficients; Multiple and partial correlation coefficients and their testing.

Unit II

Problem of correlated errors; Auto correlation; Heteroscedastic models, Durbin Watson Statistics; Removal of auto correlation by transformation; Analysis of collinear data; Detection and correction of multi collinearity, Regression analysis; Method of least squares for curve fitting; Testing of regression coefficients; Multiple and partial regressions.

Unit III

Diagnostic of multiple regression equation; Concept of weighted least squares; regression equation on grouped data; Various methods of selecting the best regression equation.

Unit IV

Concept of nonlinear regression and fitting of quadratic, exponential and power curves; Economic and optimal dose, Orthogonal polynomial.

Practical

- Correlation coefficient, various types of correlation coefficients, partial and multiple, testing of hypotheses;
- Multiple linear regression analysis, partial regression coefficients, testing of hypotheses, residuals and their applications in outlier detection;
- Handling of correlated errors, multi collinearity.
- Fitting of quadratic, exponential and power curves, fitting of orthogonal polynomials.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

VIII. Suggested Reading

- Kleinbaum DG, Kupper LL, Nizam A. 2007. *Applied Regression Analysis and Other Multivariable Methods* (Duxbury Applied) 4th Ed.
- Draper NR and Smith H. 1998. *Applied Regression Analysis*. 3rd Ed. John Wiley.
- Ezekiel M. 1963. *Methods of Correlation and Regression Analysis*. John Wiley.
- Koutsoyiannis A. 1978. *Theory of Econometrics*. MacMillan.
- Kutner MH, Nachtsheim CJ and Neter J. 2004. *Applied Linear Regression Models*. 4th Ed. With Student CD. McGraw Hill.

AST 522: Data Analysis Using Statistical Packages (2+1)

Aim of the course

This course is meant for exposing the students in the usage of various statistical packages for analysis of data. It would provide the students a hands on experience in the analysis of their research data. This course is useful to all disciplines.

Theory

Unit I

Introduction to various statistical packages: Excel, R, SAS, SPSS. Data Preparation; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

Unit II

Test for normality; Testing of hypothesis using chi-square, *t* and *F* statistics and Z-test.

Unit III

Data preparation for ANOVA and ANCOVA, Factorial Experiments, contrast analysis, multiple comparisons, Analyzing crossed and nested classified designs.

Unit IV

Analysis of mixed models; Estimation of variance components; Correlation and regression analysis, Probit, Logit and Tobit Models. Discriminant function; Factor analysis; Principal component analysis; Analysis of time series data, Fitting of non-linear models; Neural networks.

Practical

- Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data;
- Testing the hypothesis for one sample *t*-test, two sample *t*-test, paired *t*-test, test for large samples - Chi-squares test, F test, one-way analysis of variance;
- Designs for Factorial Experiments, fixed effect models, random effect models, mixed effect models, estimation of variance components;
- Linear regression, Multiple regression, Regression plots;
- Discriminant analysis - fitting of discriminant functions, identification of important variables;
- Factor analysis. Principal component analysis - obtaining principal component.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Anderson C.W. and Loynes R.M. 1987. *The Teaching of Practical Statistics*. John Wiley.
• Atkinson A.C. 1985. *Plots Transformations and Regression*. Oxford University Press.
• Chambers J.M., Cleveland W.S., Kleiner B and Tukey P.A. 1983. *Graphical Methods for Data Analysis*. Wadsworth, Belmount, California.
• Chatfield C. 1983. *Statistics for Technology*. 3rd Ed. Chapman & Hall. Chatfield C. 1995. *Problem Solving: A Statistician's Guide*. Chapman & Hall.
• Cleveland W.S. 1985. *The Elements of Graphing Data*. Wadsworth, Belmont, California.
• Ehrenberg ASC. 1982. *A Primer in Data Reduction*. John Wiley.
• Erickson B.H. and Nosanchuk T.A. 1992. *Understanding Data*. 2nd Ed. Open University Press, Milton Keynes.
• Snell E.J. and Simpson HR. 1991. *Applied Statistics: A Handbook of GENSTAT Analyses*. Chapman and Hall.
• Sprent P. 1993. *Applied Non-parametric Statistical Methods*. 2nd Ed. Chapman & Hall.
• Tufte ER. 1983. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Conn.
• Velleman PF and Hoaglin DC. 1981. *Application, Basics and Computing of Exploratory Data Analysis*. Duxbury Press.
• Weisberg S. 1985. *Applied Linear Regression*. John Wiley.
• Wetherill GB. 1982. *Elementary Statistical Methods*. Chapman & Hall.
• Wetherill GB.1986. *Regression Analysis with Applications*. Chapman & Hall.
• Cleveland WS. 1994. *The Elements of Graphing Data*, 2nd Ed., Chapman & Hall
• http://freestatistics.altervista.org/en/learning.php.
http://freestatistics.altervista.org/en/stat.php.
http://www.cas.lancs.ac.uk/glossary_v1.1/main.html.
http://www.stat.sc.edu/~grego/courses/stat706/.
• www.drs.icar.gov.in.

MCA 501: Computer Fundamentals and Programming (2+1)

Aim of the course

This is a course on Computer Fundamentals and Programming that aims at exposing the students to understand how computer works, analytical skills to solve problems using computers. And to write computer programs using C.

Theory

Unit I

Functional units of computer, I/O devices, primary and secondary memories. Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, Operator precedence, character representation; ASCII, Unicode.

Unit II

Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Constants and variables; Data types: integer, character, real, data types; Arithmetic expressions, assignment statements, logical expressions. Control flow

Unit III

Arrays and structures. Pointers, dynamic memory allocations

Unit IV

Program Structures – functions, subroutines. I/O operations, Program correctness; Debugging and testing of programs.

Practical

- Conversion of different number types;
- Creation of flow chart, conversion of algorithm/flowchart to program;
- Mathematical operators, operator precedence;
- Sequence, control and iteration;
- Arrays and string processing;
- Matrix operations, Sorting, Pointers and File processing – Reading and writing text files.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Balaguruswamy E. 2019. *Programming with ANSI C*. Tata McGraw Hill.
- Gottfried B. 2017. *Programming with C, Schaum Outline Series*. Tata McGraw Hill.
- Kanetkar Y. 1999. *Let Us C*. BPB Publ.
- Malvino A.P. and Brown J.A.. 2017. *Digital Computer Electronics*. Tata McGraw Hill.
- Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.

MCA 502: Computer Organization and Architecture (2+0)

Aim of the course

This is a course on Computer Organization and Architecture that aims at exposing the students to understand basic knowledge of how computer works.

Theory

Unit I

Number systems; Boolean algebra - minimization of Boolean function using Karnaugh Map.

Unit II

Logic Gates, Combinational circuits – multiplexer, de-multiplexer, encoder, decoder; Sequential circuits: Flip-flops, Half and Full adder, Shift register, Counters. Organization of CPU, Control Unit- Instruction and Execution cycle in CPU, Register Organization, The Instruction Cycle, Instruction Pipelining.

Unit III

Memory organization - Internal memory: Semiconductor Main Memory (RAM, ROM, EPROM), Cache Memory, Advanced DRAM Organization; External Memory - Magnetic Disks, RAID, Optical Memory, Magnetic Tape. Basic structure of computer hardware and system software - Addressing methods and machine programme sequencing; Input-output organizations - accessing I/O devices - direct memory access (DMA) – interrupts.

Unit IV

Introduction to microprocessors – CISC and RISC Architecture, Study of functional units of microprocessors.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Gear C.W. 1974. *Computer Organization and Programming*. McGraw Hill.
• Hayes J.P. 1988. *Computer Architecture and Organisation*. McGraw Hill.
• Malvino A.P and Brown J.A. 1999. *Digital Computer Electronics*. Tata McGraw Hill.
• Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.
• Mano M.M. 2007. *Computer System Architecture*. Prentice Hall of India.
• Stallings W. 2016. *Computer Organization and Architecture: Designing for Performance*. Pearson Edu.

MCA 511: Introduction to Networking and Internet Applications (1+1)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand Computer networking and web applications development.

Theory

Unit I

Networking fundamentals, types of networking, network topology; Introduction to File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol (SMTP), Internet Protocol v4 & v6.

Unit II

Network infrastructure and Security-switches, routers, firewall, intranet, internet, Virtual Private Network. World Wide Web (www), working with Internet; Web pages, web sites, web servers; Web Applications.

Unit III

Hyper Text Markup Language (HTML), DHTML, web based application development.

UNIT IV

Static websites, dynamic websites. Client Side processing – scripting languages, Jquery. Server Side processing ASP.NET/JSP

Practical

- Network and mail configuration;
- Using Network Services;
- Browsing of Internet;
- Creation of web pages;
- Creation of websites using HTML and scripting languages.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cox V, Wermers L and Reding E.E. 2006. *HTML Illustrated Complete*. 3rd Ed. Course Technology.
- Niederst J. 2001. *Web Design in a Nutshell*. O'Reilly Media.
- Tanenbaum A.S. 2003. Computer Networks. *Prentice* Hall of India.

MCA 512: Information Technology in Agriculture (2+0)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand analogy of computer, basic knowledge of MS Office. Also to understand Internet and WWW, use of IT application and different IT tools in Agriculture

Theory

Unit I

Introduction to Computers, Anatomy of computer, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions,

Unit II

Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications,

Unit III

Use of ICT in Agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc.,

Unit IV

Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions, Preparation of contingent crop-planning using IT tools.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Vanitha G. 2011. *Agro-informatics*
• http://www.*agrimoon*.com
• http://www.agriinfo.in
• http://www.eagri.org
• http://www.agriglance.com
• http://agritech.tnau.ac.in

BCM 501: Basic Biochemistry (3+1)

Why this course?
To impart the fundamental knowledge on structure and function of cellular components involved in biological processes and an elementary introduction to the study of molecular biology.

Aim of the course
The course is designed to provide elementary knowledge/overview of structure and function of proteins, carbohydrates, lipids, nucleic acids and other biomolecules and their metabolism.

Theory
UNIT-I
Block 1: Introduction to Biochemistry-8
Section 1: Scope and importance of biochemistry (1 Lecture)
Biochemistry as modern science and its various divisions, Scope and importance of biochemistry in agriculture and allied sciences.
Section 2: Foundation of life (2 Lectures)
Fundamental principles governing life, supramolecular structures, significance of weak non covalent interactions in biology
Section 3: Water (3 Lectures)
Structure of water, ionization of water, acid base concept, pH and buffers, significance of structure-function relationship.
Section 4: Physical techniques for structure determination (2 Lectures)
General introduction to physical techniques for determination of structure of biopolymers.

UNIT-II
Block 2: Structure And Function of Biomolecules -15
Section 1: Biomolecules (10 Lectures)
Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids.
Section 2: Immunoglobulins and PR proteins (2 Lectures)
Structure, formation and different forms of immunoglobulins, PR proteins and their classification.
Section 3: Plant secondary metabolites (3 Lectures)
Structure, classification and function of plant secondary metabolites.

UNIT-III
Block 3: Metabolism – The Basics
Section 1: Molecules aiding metabolism (2 Lectures)
Structure and biological functions of vitamins and coenzymes, enzymes: classification and mechanism of action; regulation, factors affecting enzyme action. Hormones: animal and plants.
Section 2: Thermodynamics –principles and energetic of life (2 Lectures)
Fundamentals of thermodynamic principles applicable to biological processes, Bioenergetics.

Block 4: Catabolism and its Regulation

Section 1: Catabolism of energy molecules (5 Lectures)

Important and basic degradative metabolic pathways of carbohydrates, lipids and proteins and their regulation.

Section 2: ATP formation (3 Lectures)

Formation of ATP, substrate level phosphorylation, electron transport chain and oxidative phosphorylation, chemiosmotic theory and proton motive force.

UNIT-IV

Block 5: Fundamentals of Molecular Biology and Genetic Engineering

Section 1: Molecular biology processes (4 Lectures)

Overview of replication, transcription and translation.

Section 2: Recombinant DNA technology (3 Lectures)

Restriction enzymes, DNA cloning, applications of cloning, transgenics.

Practicals

- Preparation of standard and buffer solutions
- Detection of carbohydrates, amino acids and proteins
- Extraction and estimation of sugars
- Extraction and estimation of amino acids
- Extraction and estimation of proteins
- Estimation of acid value of fat/oil
- Estimation of peroxide value of fat/oil
- Estimation of saponification value in fats and oils
- Fatty acid composition in fat/oil by GC
- Estimation of DNA and RNA by spectroscopic methods
- Estimation of Ascorbic acid
- Separation of biomolecules by TLC and Paper chromatography
- Estimation of alpha amylase activity
- Qualitative tests for secondary plant metabolites.

Teaching methods/activities

– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz

Learning outcome

With this course, the students are expected to be able to understand the actual chemical concepts and fundamental processes of biology at molecular level.

Suggested Reading

• Nelson DL and Cox MM. 2017. *Lehninger Principles of Biochemistry*. 7th edition. W. H. Freeman & Co Ltd
• Satyanarayana U and Chakrapani U. 2017. *Biochemistry*. 5th edition, Elsevier
• Moran LA, Horton HR, Scrimgeour KG and Perry MD. 2012. *Principles of Biochemistry*. 5th edition Pearson.
• Voet D and Voet JG. 2011. *Biochemistry*. 4th edition John Wiley.
• Pratt CW and Cornely K. 2014. *Essential Biochemistry*. 3rd Edition. Wiley
• Moorthy K. 2007. *Fundamentals of Biochemical Calculations*. 2nd edition. CRC Press
• Conn EE, Stumpf PK, Bruening G and Doi RH. 2006. *Outlines of Biochemistry*. 5th edition. Wiley.

BCM 505: Techniques in Biochemistry (2+2)

Why this course?

Biochemical studies rely on the availability of appropriate analytical techniques and their applications. This course will examine modern methods and technologies that are used in biochemical analysis with emphasis on instrumentation, underlying principles, aims, strategies and current applications.

Aim of the course

To provide hands-on experience to different biochemical techniques commonly used in research along with the knowledge on principles and the instrumentation**.**

Theory

Unit I

Block 1: Separation Techniques

Principles and applications of separation techniques.

Section 1: Chromatography techniques (4 Lectures)

Principles and applications of paper, thin layer, gel filtration, ion-exchange, affinity, column & HPTLC, GC, HPLC and FPLC.

Section 2: Electrophoretic technique (2 Lectures)

General principles, paper and gel electrophoresis, native and SDS-PAGE, 2D-PAGE, capillary electrophoresis.

Section 3: Hydrodynamic methods (2 Lectures)

Hydrodyanmic methods of separation of biomolecules such as viscosity and sedimentation velocity, - their principles.

Section 4: Centrifugation (2 Lectures)

Basic principles of sedimentation, type, care and safety aspects of centrifuge preparative and analytical centrifugation.

Unit II

Block 2: Spectroscopic Techniques

Section 1: Spectrophotometry (3 Lectures)

Principles and applications of UV-visible, Fluorescence, IR and FTIR, Raman, NMR and FTNMR, ESR and X-Ray spectroscopy.

Section 2: Mass spectroscopy (3 Lectures)

MS/MS, LC-MS, GC-MS, MALDI-TOF, applications of mass spectrometry in biochemistry.

Section 3: Atomic absorption spectrophotometry (2 Lectures)

Principle, function and instrumentation of atomic absorption spectrophotometry.

Unit III
Block 3. Microscopy
Section 1: Microscopic techniques (2 Lectures)
Principles and applications, light, UV, phase contrast, fluorescence and electron microscopy, flow cytometry.

Unit IV
Block 4: Tracer, Imaging, Immunochemical and Other Techniques
Section 1: Tracer technique (2 Lectures)
Tracer techniques in biology: concept of radioactivity, radioactivity counting methods with principles of different types of counters, concept of á, â and ã emitters, scintillation counters, Gamma-ray spectrometers, autoradiography, applications of radioactive tracers in biology.
Section 2: Imaging techniques (2 Lectures)
Principles and applications of phosphor imager, MRI and CT scan.
Section 3: Immunochemical technique (2 Lectures)
Production of antibodies, immunoprecipitation, immunoblotting, immunoassays, RIA and ELISA.
Section 4: Other techniques (2 Lectures)
Cryopreservation, polymerase chain reaction (PCR), FACS.

Practicals
• Expression of concentration in terms of dilution, molarity, normality, percent expression
• pH measurement and buffer preparation
• Determination of absorption maxima of biomolecules
• Estimation of biomolecules through spectrophotometry and other methods
• Separation of carbohydrates and amino acids by paper chromatography
• Separation and analysis of fatty acids/lipids by GC
• Separation/estimation of biomolecules through HPLC and FPLC
• Separation of proteins using ion exchange, gel filtration and affinity chromatography
• Electrophoretic separation of proteins and nucleic acids
• Centrifugation- differential and density gradient
• (NH4)2SO4 precipitation and dialysis
• Use of radioisotopes in metabolic studies
• PCR
• ELISA
• Western blotting/ Dot blotting

Teaching methods/activities
– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz
– Case study

Learning outcome

At the end of the course, the student will acquire the basic knowledge of the main biochemical methods used in the separation, identification, characterization and analysis of biomolecules.

Suggested Reading

• Boyer R. 2011. *Biochemistry Laboratory: Modern Theory and Techniques* 2nd Edition. Pearson
• Hofmann A and Clokie S. 2010. *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*. 7th edition. Cambridge University Press.
• Sawhney SK and Singh R. 2000. *Introductory Practical Biochemistry*. 2nd Ed. Narosa
• Katoch R. 2011. *Analytical Techniques in Biochemistry and Molecular Biology*. Springer
• Boyer R. 2009. *Modern Experimental Biochemistry*. Fifth impression. Pearson
• Lottspeich F and Engels JW. (Eds). 2018. *Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology.* Wiley-VCH
• Wilson K and Walker J. 2010. *Principles and Techniques of Biochemistry and Molecular Biology*, 7th Edition. Cambridge University Press

SYLLABUS FOR ENTOMOLOGY COURSES FOR M. Sc. (AGRI.) IN ENTOMOLOGY

ENT 501: Insect Morphology 3 (2+1)

Aim of the course

To acquaint the students with the external morphology of the insect's body and the functioning of various body parts.

Theory

Unit I

External Morphology: Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

Head- Origin, **s**tructure and modification; mouthparts, antennae, their types and functioning; tentorium and neck sclerites.

Unit II

Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; legs: structure and modifications.

Abdomen- Segmentation and appendages; genitalia and their modifications; embryonic and post-embryonic development.

Unit III

Insect sense organs (mechano-, photo- and chemo- receptors); organogenensis at pupal stage; insect defense; chaetotaxy; morphological traits in relation to forensic entomology.

Unit IV

Types of immature stages in insect orders, morphology of egg, nymph/ larva and pupa, identification of different immature stages of crop pests and stored product insects. Comparative study of life history strategies in hemi-metabola and holometabola, immature stages as ecological and evolutionary adaptations, significance of immature stages for pest management.

Practical

- Preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia;
- Dissection of genitalia. Types of immature stages in insects; their collection, rearing and preservation;
- Identification of immature insects to orders and families, in endopterygote orders, viz., Diptera, Lepidoptera, Hymenoptera and Coleoptera using key;

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/ Insect Submission)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Actual rearing of Insects to study changes in morphology
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to have a complete understanding of the comparative morphology of the external features of insects that can be utilized in taxonomy, ecology and applied entomology.

Suggested Reading

Chapman RF. 1998. *The Insects: Structure and Function*. Cambridge Univ. Press, Cambridge.

Chu HF. 1992. *How to Know Immature Insects*. William Brown Publication, Iowa.

Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publishers, New Delhi.

Evans JW. 2004. *Outlines of Agricultural Entomology*. Asiatic Publ., New Delhi.

Gillott C. 1995. *Entomology*, 2nd Ed. Plenum Press, New York, London.

Gullan PJ and Cranston PS. 2000. *The Insects, An Outline of Entomology*, 2nd Ed. Blackwell Science, UK.

Peterson A. 1962. *Larvae of Insects*. Ohio University Press, Ohio.

Richards OW and Davies RG. 1977. *Imm's General Text Book of Entomology*. 10th Ed. Chapman and Hall, London.

Snodgross RE. 1993. *Principles of Insect Morphology.* Cornell Univ. Press, Ithaca.

Tembhore DB. 2000. *Modern Entomology,* Himalaya Publishing House, Mumbai.

Stehr FW. 1998. *Immature Insects*. Vols. I, II. Kendall Hunt Publication, Iowa.

ENT 502: Insect Anatomy and Physiology 3 (2+1)

Aim of the course
To impart knowledge about the anatomy and physiology of insect body systems; nutritional physiology; and their applications in entomology.

Theory
Unit I
Scope and importance of insect physiology; physiology of integument, moulting, chemistry of cuticle, biosysthesis of chitin; growth, hormonal control, metamorphosis and diapause; pheromone secretion, transmission, perception and reception.

Unit II
Physiology and mechanism of digestion, circulation, respiration, excretion, reproduction,

UNIT III
Insect secretions (exocrine and endocrine glands) and nerve impulse transmission in insects.

Unit IV
Importance of insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.

Practical
• Latest analytical techniques for analysis of free amino acids of haemolymph;
• Determination of chitin in insect cuticle;
• Examination and count of insect haemocytes; preparation and evaluation of various diets;
• Consumption, utilization and digestion of natural and artificial diets.

PEDAGOGY (Teaching methods/activities)
- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Student discussions

Learning outcome
• Students are expected to have a thorough understanding of insect growth and development, physiology of exoskeleton, endoskeleton and different organ systems; action and role of hormones, pheromones, physiology of nutrition and its application.

IX. Suggested Reading

Chapman RF. 1998. *Insects: Structure and Function*. ELBS Ed., London.

Dunston PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publishers, New Delhi.

Gullan PJ and Cranston PS. 2000. *The Insects*: *An Outline of Entomology*, 2nd Ed. Blackwell Science, UK.

Kerkut GA and Gilbert LI. 1985. *Comprehensive Insect Physiology, Biochemistry and Pharmacology.* Vols. I-XIII. Pergamon Press, New York.

Patnaik BD. 2002. *Physiology of Insects*. Dominant Publishers, New Delhi.

Richards OW and Davies RG. 1977. *Imm's General Text Book of Entomology.* 10th Ed. Vol. 1. *Structure, Physiology and Development.* Chapman and Hall, New York.

Simpson SJ. 2007. *Advances in Insect Physiology*, Vol. 33, Academic Press (Elsevier), London, UK.

Wigglesworth VB. 1984. *Insect Physiology.* 8th Ed. Chapman and Hall, New York.

ENT 503: Insect Taxonomy **3 (1 + 2)**

Aim of the course

To sensitize the students on the theory and practice of classifying organisms (with special reference to animals) and the rules governing the same. To introduce the students to the classification of insects up to the level of families with hands-on experience in identifying the families of insects with an emphasis on the practical aspects.

Theory

Unit I

History of insect classification; principles of systematics and its importance. Identification, purpose, methods character matrix, taxonomic keys. Descriptions, subjects of descriptions, characters, nature of characters, analogy *v/s* homology, parallel *v/s* convergent evolution, intraspecific variation in characters, polythetic and polymorphic taxa, sexual dimorphism. Brief evolutionary history of insects. Introduction to phylogeny of insects and International Code of Zoological Nomenclature, Phylocode, its brief explanation and uses. Process of speciation and interbreeding allopatric species. Molecular systemnatics, DNA barcoding, karyological and biochemical approaches in taxonomy. Insect labeling protocols and procedures.

Unit II

Classification of Superclass Hexapoda – Classes – Ellipura (Collembola, Protura), Diplura and Insecta- and the Orders contained. Distinguishing characters, general biology, habits and habitats of insect orders and economically important families contained in them. Collembola, Protura, Diplura.

Unit III

Class Insecta: Subclass Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera – Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

Unit IV

Distinguishing characters, general biology, habits and habitats of insect orders and economically important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

Practical

• Study of Orders of insects and their identification using taxonomic keys;
• Keying out families of insects of different major Orders: Odonata, Orthoptera, Blattodea, Mantodea, Isoptera, Hemiptera, Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera;
• Field visits to collect insects of different orders.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/ Insect Submission)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Actual rearing of Insects to study changes in morphology
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to know the evolution of arthropods, especially insects and other hexapods, and their hierarchical classification
• Acquire working skills for collecting, mounting, and preserving insects
• Understand the basic concepts of taxonomic hierarchy, identification, taxonomic characters, variations, taxonomic keys and preparation of taxonomic papers
• Identify insects of economic importance up to family levels, taking up the insect orders of agriculture and veterinary importance

Suggested Reading

CSIRO 1990. *The Insects of Australia: A Text Book for Students and Researchers*. 2nd Ed. Vols. I and II, CSIRO. Cornell Univ. Press, Ithaca.

Freeman S and Herron JC. 1998. *Evolutionary Analysis*. Prentice Hall, New Delhi.

Gullan PJ and Cranston PS. 2010. *The Insects: An outline of Entomology*. 4th Ed. Wiley-Blackwell Publications, West Sussex, UK.

Mayr E. 1971. *Principles of Systematic Zoology*. Tata McGraw Hill, New Delhi.

Richards OW and Davies RG. 1977. *Imm's General Text Book of Entomology*. 10th Ed. Chapman and Hall, London.

Ross HH.1974. *Biological Systematics.* Addison Wesley Publ. Company.

Triplehorn CA and Johnson NF. 1998. *Borror and DeLong's Introduction to the Study of Insects.* 7th Ed. Thomson/ Brooks/ Cole, USA/ Australia.

ENT 504: Insect Ecology 3 (2+1)

Aim of the course

To teach the concepts of ecology, basic principles of distribution and abundance of organisms and their causes. Study life tables, constructing life tables, organization of communities, diversity indices. Train students in sampling methodology, calculation of diversity indices, relating insect population fluctuations to biotic and/ or abiotic causes.

Theory

Unit I

History and definition. Basic Concepts. Organisation of the Biological world. Plato's Natural Balance *vs* Ecological Dynamics as the modern view. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalised action on insects. Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis, Systems approach to ecology.

Unit II

Basic concepts of abundance- Model *vs* Real world. Population growth basic models – Exponential *vs* Logistic models. Discrete *vs* Continuous growth models. Concepts of Carrying capacity, Environmental Resistance and Optimal yield. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) – aestivation, hibernation.

Unit III

Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain- web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions – The argument of cost-benefit ratios. Competition- Lotka-Volterra model, Concept of niche ecological homologues, competitive exclusion. Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.

Unit IV

Community ecology- Concept of guild, Organisation of communities- Hutchinson Ratio, May's *d/w*, Relation between the two and their association with Dyar's Law and Przibram's law. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology. Climate change and insect pest/ natural enemy population; ecological engineering.

Practical

- Types of distributions of organisms;
- Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters- Measures of central tendencies, Poisson Distribution, Negative Binomial Distribution;
- Determination of optimal sample size. Learning to fit basic population growth models and testing the goodness of fit;
- Fitting Holling's Disc equation;
- Assessment of prey-predator densities from natural systems and understanding the correlation between the two;
- Assessing and describing niche of some insects of a single guild;
- Calculation of niche breadth, activity breadth and diagrammatic representation of niches of organisms;
- Calculation of diversity indices- Shannon's, Simpson's and Avalanche Index and understanding their associations and parameters that affect their values;
- Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and interpretations
- Oral presentation by students on specified topics
- Experimentation
- Field visits and Estimations of Insects/Distribution
- Student discussions

Learning outcome

- The students are expected to be well versed with the basic concepts of ecology, ecological succession, population ecology, community ecology, nutritional ecology and different insect-ecosystem interactions
- Quantification of insect diversity and abundance, life table analyses, predator-prey and host-parasitoid relations, functional and numerical responses, niche breadth and overlap

Suggested Reading

Begon M, Townsend CR and Harper JL. 2006. *Ecology: From Individuals to Ecosystems*. 4th Ed. Blackwell Publishing, USA/ UK/ Australia.

Chapman JL and Reiss MJ. 2006. *Ecology: Principles and Applications*. 2nd Ed. Cambridge Univ. Press, Cambridge.

Fowler J, Cohen L and Jarvis P. 1998. Practical Statistics for Field Biology. 2nd Ed. John Wiley & Sons, Chichester, West Sussex PO19 8SQ, England.

Gotelli NJ and Ellison AM. 2004. *A Primer of Ecological Statistics.* Sinauer Associates, Inc., Sunderland, MA.

Gotelli NJ. 2001. *A Primer of Ecology.* 3rd Ed. Sinauer Associates, Inc., Sunderland, MA

Gupta RK. 2004. *Advances in Insect Biodiversity*. Agrobios, Jodhpur.

Krebs CJ. 1998. *Ecological Methodology*. 2nd Ed. Benjamin-Cummings Publ. Co., New York.
Krebs CJ. 2001. *Ecology: The Experimental Analysis of Distribution and Abundance.* 5th Ed. Benjamin-Cummings Publ. Co., New York.
Magurran AE. 1988. *Ecological Diversity and its Measurement.* Princeton Univ. Press, Princeton.
Price PW. 1997. *Insect Ecology*. 3rd Ed. John Wiley, New York.
Real LA and Brown JH. (Eds). 1991. *Foundations of Ecology: Classic Papers with Commentaries*. University of Chicago Press, Chicago.
Schowalter Timothy D. 2011. *Insect Ecology – An Ecosystem Approach*. 3rd Ed. Academic Press, London, UK/ CA, USA.
Southwood TRE and Henderson PA. 2000. *Ecological Methods.* 3rd Ed. Methuen and Co. Ltd., London.
Speight MR, Hunta MD and Watt AD. 2006. *Ecology of Insects: Concepts and Application*. Elsevier Science Publ., The Netherlands.
Townsend Colin R, Begon Michael and Harper John L. 2008. *Essentials of Ecology*. 3rd Ed. Blackwell Publishing, USA/ UK/ Australia.
Wilson EO, William H and Bossert WH. 1971. *A Primer of Population Biology*. Harvard University, USA.
Wratten SD and Fry GLA. 1980. *Field and Laboratory Exercises in Ecology*. Arnold, London.

ENT 505: Biological Control of Insect Pests And Weeds 3 (2+1)

Aim of the course

To train the students with theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic microorganisms.

Theory

Unit I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes.

Unit II

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa, etc., their mode of action. Biological control of weeds using insects. Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these. Defense mechanisms in insects against pathogens.

Unit III

Mass production of quality bio-control agents- techniques, formulations, economics, field release/ application and evaluation. Development of insectaries, their maintenance.

Unit IV

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

Practical

- Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers;
- Visits to bio-control laboratories to learn rearing and mass production of egg, egglarval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds;
- Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Field visits and Experimentation
- Student discussions

Learning outcome

• Students are expected to have a good understanding of the role of natural enemies in managing pest populations below those causing economic damage

• Learn the techniques for mass production of quality bio-agents and their optimal use in IPM

Suggested Reading

Burges HD and Hussey NW. (Eds). 1971. *Microbial Control of Insects and Mites.* Academic Press, London.

De Bach P. 1964. *Biological Control of Insect Pests and Weeds.* Chapman and Hall, New York.

Dhaliwal GS and Arora R. 2001. *Integrated Pest Management: Concepts and Approaches.* Kalyani Publishers, New Delhi.

Gerson H and Smiley RL. 1990. *Acarine Biocontrol Agents – An Illustrated Key and Manual.* Chapman and Hall, New York.

Huffaker CB and Messenger PS. 1976. *Theory and Practices of Biological Control.* Academic Press, London.

Ignacimuthu SS and Jayaraj S. 2003. *Biological Control of Insect Pests*. Phoenix Publ., New Delhi.

Saxena AB. 2003. *Biological Control of Insect Pests*. Anmol Publ., New Delhi.

Van Driesche and Bellows TS. Jr. 1996. *Biological Control*. Chapman and Hall, New York.

ENT 506: Toxicology of Insecticides 3 (2+1)

Aim of the course

To orient the students with structure and mode of action of important insecticides belonging to different groups, development of resistance to insecticides by insects, environmental pollution caused by toxic insecticides and their toxicological aspects.

Theory

Unit I

Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India.

Unit II

Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature; categorization of insecticides on the basis of toxicity – criteria for bees, beneficial insects and other insects in general; structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals, new promising compounds/ new insecticide molecules; nanopesticides; drawbacks of insecticide abuse.

Unit III

Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity. bioassay definition, objectives, criteria, factors, problems and solutions.

Unit IV

Insecticide metabolism; insect-pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence. Insecticide residues, their significance and environmental implications; procedures of insecticide residue analysis. Insecticide Act, registration procedures, label claim, and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

Practical

- Insecticide formulations and mixtures;
- Laboratory and field evaluation of bio-efficacy of insecticides;
- Bioassay techniques;
- Probit analysis;
- Evaluation of insecticide toxicity;
- Toxicity to beneficial insects;
- Pesticide appliances;
- Working out doses and concentrations of pesticides;
- Procedures of residue analysis.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Experimentation
- Field visits and Observations
- Student discussions

Learning outcome

• Students are expected understand the concept of toxicity, bio-efficacy, insecticide formulations, modes of action of insecticides, estimation of insecticide residues and have significant know-how about the functioning of various types of spray equipments.

Suggested Reading

Chattopadhyay SB. 1985. *Principles and Procedures of Plant Protection.* Oxford and IBH, New Delhi.

Dodia DA, Petel IS and Petal GM. 2008. *Botanical Pesticides for Pest Management*. Scientific Publisher (India), Jodhpur.

Dovener RA, Mueninghoff JC and Volgar GC. 2002. Pesticides formulation and delivery systems: meeting the challenges of the current crop protection industry. ASTM, USA

Gupta HCL.1999. *Insecticides: Toxicology and Uses.* Agrotech Publ., Udaipur.

Ishaaya I and Degheele (Eds.). 1998. *Insecticides with Novel Modes of Action.* Narosa Publ. House, New Delhi.

Ishaaya I and Degheele D. 1998. *Insecticides with Novel Modes of Action: Mechanism and Application*. Norosa Publishing House, New Delhi.

Krieger RI. 2001. *Handbook of Pesticide Toxicology*. Vol-II. Academic Press. Orlando Florida.

Mathews GA. 2002. *Pesticide Application Methods*. 4th Ed. Intercept. UK.

Matsumura F. 1985. *Toxicology of Insecticides.* Plenum Press, New York.

Otto D and Weber B. 1991. *Insecticides: Mechanism of Action and Resistance*. Intercept Ltd., UK.

Pedigo LP and Marlin ER. 2009. *Entomology and Pest Management*, 6th Edition, Pearson Education Inc., Upper Saddle River, New Jersey 07458, U.S.A.

Perry AS, Yamamoto I, Ishaaya I and Perry R. 1998. *Insecticides in Agriculture and Environment.* Narosa Publ. House, New Delhi.

Prakash A and Rao J. 1997. *Botanical Pesticides in Agriculture.* Lewis Publication, New York.

Roy NK. 2006. *Chemistry of Pesticides*. Asia Printograph Shahdara Delhi.

ENT 507: Host Plant Resistance 2 (1+1)

Aim of the course
To orient the students with host plant resistance.

Theory
Unit I
History and importance of resistance; principles, classification, components, types and mechanisms of resistance.Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects.

Unit II
Chemical ecology, tritrophic relations, volatiles and secondary plant substances; basis of resistance. Induced resistance – acquired and induced systemic resistance.

Unit III
Factors affecting plant resistance including biotypes and measures to combat them.

Unit IV
Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world. Role of biotechnology in plant resistance to insects.

Practical
• Screening techniques for measuring resistance;
• Measurement of plant characters and working out their correlations with plant resistance;
• Testing of resistance in important crops;
• Bioassay of plant extracts of susceptible/ resistant varieties;
• Demonstration of antibiosis, tolerance and antixenosis.

PEDAGOGY (Teaching methods/activities)
- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Oral presentation by students on specified topics
- Field visits
- Student discussions

Learning outcome
• Students are expected to acquire a thorough knowledge of the types and basis of mechanisms involved in host plant resistance, screening techniques to measure resistance and insect resistance breeding.

Suggested Reading

Dhaliwal GS and Singh R. (Eds). 2004. *Host Plant Resistance to Insects -Concepts and Applications.* Panima Publ., New Delhi.

Maxwell FG and Jennings PR. (Eds). 1980. *Breeding Plants Resistant to Insects.* John Wiley and Sons, New York.

Painter RH. 1951. *Insect Resistance in Crop Plants*. MacMillan, London.

Panda N and Khush GS. 1995. *Plant Resistance to Insects.* CABI, London.

Smith CM. 2005. *Plant Resistance to Arthropods – Molecular and Conventional Approaches.* Springer, Berlin.

ENT 508: Concepts of Integrated Pest Management 2 (2+0)

Aim of the course

To familiarize the students with principles of insect pest management, including concept and philosophy of IPM**.** Train students in computation of ETL and implementing IPM programmes.

Theory

Unit I

History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons.

Unit II

Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects.

Unit III

Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical and mechanical methods; semiochemicals, biotechnological and bio-rational approaches in IPM. Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; case studies of successful IPM programmes. ITK-s in IPM, area-wide IPM and IPM for organic farming; components of ecological engineering with successful examples.

Unit IV

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Oral presentation by students on specified topics
- Student discussions

Learning outcome

• Students are expected to have significant knowledge of IPM concepts, estimation of losses due to insect pests, computation of ETL, EIL and should be able take management decisions.

Suggested Reading

Dhaliwal GS and Arora R. 2003. *Integrated Pest Management – Concepts and Approaches.* Kalyani Publishers, New Delhi.

Horowitz AR and Ishaaya I. 2004. *Insect Pest Management: Field and Protected Crops*. Springer, New Delhi.

Ignacimuthu SS and Jayaraj S. 2007. *Biotechnology and Insect Pest Management*. Elite Publ., New Delhi.

Norris RF, Caswell-Chen EP and Kogan M. 2002. *Concepts in Integrated Pest Management.* Prentice Hall, New Delhi.

Pedigo RL. 2002. *Entomology and Pest Management.* 4th Ed. Prentice Hall, New Delhi.

Subramanyam B and Hagstrum DW. 1995. *Integrated Management of Insects in Stored Products.* Marcel Dekker, New York.

ENT 509: Pests of Field Crops 3 (2+1)

Aim of the course

To familiarize the students about nature of damage and seasonal incidence of pestiferous insects that cause loss to major field crops and their effective management by different methods.

Theory

Unit I

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors. Insect pest scenario in relation to climate change. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs, etc.).

Unit II

Insect pests of cereals and millets and their management.

Unit III

Insect pests of pulses, tobacco, oilseeds and their management.

Unit IV

Insect pests of fibre crops, forage crops, sugarcane and their management.

Practical

• Field visits, collection and identification of important pests and their natural enemies;
• Detection and estimation of infestation and losses in different crops;
• Study of life history of important insect pests.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to acquire knowledge of insect pests of field crops, their nature of damage, life history traits and effective management.

Suggested Reading

David, BV and Ramamurthy, VV. 2001. *Elements of Economic Entomology.* Popular Book Depot, Chennai.

Dhaliwal GS, Singh R and Chhillar BS. 2006. *Essentials of Agricultural Entomology.* Kalyani Publishers, New Delhi.

Dunston AP. 2007. *The Insects: Beneficial and Harmful Aspects*. Kalyani Publishers, New Delhi

Evans JW. 2005. *Insect Pests and their Control*. Asiatic Publ., New Delhi.

Nair MRGK. 1986. *Insect and Mites of Crops in India.* ICAR, New Delhi.

Prakash I and Mathur RP. 1987. *Management of Rodent Pests.* ICAR, New Delhi.

Saxena RC and Srivastava RC. 2007. *Entomology at a Glance*. Agrotech Publ. Academy, Udaipur.

ENT 510: Pests of Horticultural and Plantation Crops 3 (2+1)

Aim of the course

To impart knowledge on major pests of horticultural and plantation crops regarding the extent and nature of loss, seasonal history, their integrated management.

Theory

Unit I

Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops.
Fruit Crops- mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, *ber*, fig, citrus, *aonla*, pineapple, apple, peach and other temperate fruits.

Unit II

Pests of Vegetable crops- tomato, potato, radish, carrot, beetroot, cole crops, French beans, chow-chow, brinjal, okra, all gourds, drumstick, leafy vegetables, etc.

Unit III

Pests of Plantation crop- coffee, tea, rubber, coconut, arecanut, cashew, cocoa, etc.; Spices and Condiments- pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, beetlevine, etc.

Unit IV

Ornamental, medicinal and aromatic plants and pests in polyhouses/ protected cultivation.

Practical

• Collection and identification of important pests and their natural enemies on different crops;
• Study of life history of important insect pests and non-insect pests.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to acquire knowledge of insect pests of horticultural, medicinal and plantation crops, their nature of damage, life history traits and effective management.

Suggested Reading

Atwal AS and Dhaliwal GS. 2002. *Agricultural Pests of South Asia and theirManagement.* Kalyani Publishers, New Delhi.

Butani DK and Jotwani MG. 1984. *Insects and Vegetables.* Periodical Expert Book Agency, New Delhi.

Dhaliwal GS, Singh R and Chhillar BS. 2006. *Essential of Agricultural Entomology.* Kalyani Publishers, New Delhi.

Srivastava RP. 1997. *Mango Insect Pest Management.* International Book Distr., Dehra Dun.

Verma LR, Verma AK and Goutham DC. 2004. *Pest Management in Horticulture Crops*: *Principles and Practices*. Asiatech Publ., New Delhi.

ENT 511: Post Harvest Entomology 2 (1+1)

Aim of the course

To focus on requirement and importance of grain and grain storage, to understand the role of stored grain pests and to acquaint with various stored grain pest management techniques for avoiding losses in storage.

Theory

Unit I

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses *in toto vis-à-vis* total production of food grains in India. Scientific and socio-economic factors responsible for grain losses. Concept of seed vault.

Unit II

Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes.

Unit III

Ecology of insect pests of stored commodities/ grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage- types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions.

Unit IV

Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures- Hygiene/ sanitation, disinfestations of stores/ receptacles, legal methods. Curative measures- Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control prophylactic and curative- Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Insecticide resistance in stored product pests and its management; recent advances (MAS, PPP, HS) in storage pest management; integrated approaches to stored grain pest management.

Practical

- Collection, identification and familiarization with the stored grains/ seed insect pests and nature of damage caused by them;
- Detection of hidden insect infestation in stored food grains;
- Estimation of uric acid content in infested produce; estimation of losses in stored food grains;
- Determination of moisture content in stored food grains;
- Familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques;
- Treatment of packing materials and their effect on seed quality;
- Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, Mysore; IGSMRI, Hapur, etc. (only where logistically feasible).

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Collection of live cultures of Storage pests and their maintenance
- Visits to Ware Houses
- Student discussions

Learning outcome

- Students are expected to acquire knowledge of pestiferous insects, mites, rats and birds affecting stored produce, their nature of damage, life history traits and effective management.
- Detection of insect infestation and familiarization with different storage structures.
- Learning preventive and curative measures to manage infestation in storage houses.

Suggested Reading

Hall DW. 1970. *Handling and Storage of Food Grains in Tropical and Subtropical Areas.* FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome.

Jayas DV, White NDG and Muir WE. 1995. *Stored Grain Ecosystem.* Marcel Dekker, New York.

Khader V. 2004. *Textbook on Food Storage and Preservation*. Kalyani Publishers, New Delhi.

Khare BP. 1994. *Stored Grain Pests and Their Management.* Kalyani Publishers, New Delhi.

Subramanyam B and Hagstrum DW. 1995. *Interrelated Management of Insects in Stored Products.* Marcel Dekker, New York.

ENT 512: Insect Vectors of Plant Pathogens 2 (1+1)

Aim of the course

To teach the students about the different groups of insects that act as vectors of plant pathogens, vector-plant pathogen interaction, and management of vectors for controlling diseases.

Theory

Unit I

History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

Unit II

Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors. Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.

Unit III

Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.

Unit IV

Transmission of plant viruses by psyllids, beetles and mites. Epidemiology and management of insect transmitted diseases through vector management.

Practical

• Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes;
• Culturing and handling of vectors; demonstration of virus transmission through vectors- aphids, leafhoppers and whiteflies;
• Vector rearing and maintenance;
• Estimating vector transmission efficiency, studying vector-virus host interaction.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to be well versed with insect vectors of plant pathogens, acquire knowledge on disease transmission and vector management techniques.

Suggested Reading

Basu AN. 1995. *Bemisia tabaci* (Gennadius) – *Crop Pest and Principal Whitefly Vector of Plant Viruses.* Oxford and IBH, New Delhi.

Harris KF and Maramarosh K. (Eds.). 1980. *Vectors of Plant Pathogens*. Academic Press, London.

Maramorosch K and Harris KF. (Eds.). 1979. *Leafhopper Vectors and Plant Disease Agents*. Academic Press, London.

Youdeovei A and Service MW. 1983. *Pest and Vector Management in the Tropics*. English Language Books Series, Longman, London.

ENT 513: Principles of Acarology 2 (1+1)

Aim of the course

To acquaint the students with external morphology of different groups of mites, train in identification of commonly occurring families of plant associated mites, provide information about important mite pests of crops and their management.

Theory

Unit I

History of Acarology; importance of mites as a group; habitat, collection and preservation of mites. Soil arthropods and their classification, habitats and their identification.

Unit II

Introduction to morphology and biology of mites and ticks. Broad classification major orders and important families of Acari including diagnostic characteristics. Estimation of populations; sampling and extraction methods for soil arthropods.

Unit III

Economic importance, seasonal occurrence, nature of damage, host range of mite pests of different crops, mite pests in polyhouses, mite pests of stored products and honeybees.

Unit IV

Management of mites using acaricides, phytoseiid predators, fungal pathogens, etc. Culturing of phytophagous, parasitic and predatory mites. Mode of action of acaricides, resistance of mites and ticks to acaricides, its management.

Practical

- Collection of mites from plants, soil and animals;
- Extraction of mites from soil, plants and stored products;
- Preparation of mounting media and slide mounts;
- External morphology of mites;
- Identification of mites up to family level using keys;
- Studying different rearing techniques for mites.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits and collections and preservation of mites
- Student discussions

Learning outcome

• Students are expected to identify mites up to family level.
• Acquire knowledge of mite pests of cultivated crops, their nature of damage, life history traits and effective management.

Suggested Reading

Anderson JM and Ingram JSI. 1993. *Tropical Soil Biology and Fertility: A Handbook of Methods.* CABI, London.

Chhillar BS, Gulati R and Bhatnagar P. 2007. *Agricultural Acarology*. Daya Publ. House, New Delhi.

Dindal DL. 1990. *Soil Biology Guide*. A Wiley-InterScience Publ., John Wiley and Sons, New York.

Gerson U and Smiley RL. 1990. *Acarine Biocontrol Agents – An Illustrated Key and Manual*. Chapman and Hall, NewYork.

Gupta SK. 1985. *Handbook of Plant Mites of India.* Zoological Survey of India, Calcutta.

Gwilyn O and Evans GO. 1998. *Principles of Acarology*. CABI, London.

Jeppson LR, Keifer HH and Baker EW. 1975. *Mites Injurious to Economic Plants*. University of California Press, Berkeley.

Krantz GW. 1970. *A Manual of Acarology.* Oregon State Univ. Book Stores, Corvallis, Oregon.

Pankhurst C, Dube B and Gupta, V. 1997. *Biological Indicators of Soil Health.* CSIRO, Australia.

Qiang Zhiang Z. 2003. *Mites of Green Houses- Identification, Biology and Control*. CABI, London.

Sadana GL. 1997. *False Spider Mites Infesting Crops in India.* Kalyani Publishers House, New Delhi.

Walter DE and Proctor HC. 1999. *Mites- Ecology, Evolution and Behaviou*r. CABI, London.

Veeresh GK and Rajagopal D. 1988. *Applied Soil Biology and Ecology*. Oxford and IBH Publ., New Delhi.

ENT 514: Vertebrate Pest Management 2 (1+1)

Aim of the course

To impart knowledge on vertebrate pests like birds, rodents, mammals and others of different crops, their biology, damage they cause and management strategies.

Theory

Unit I

Introduction to vertebrate pests of different crops; biology of vertebrate pests such as rodents, birds and other mammals. Bio-ecology of birds of agricultural importance, patterns of pest damage and assessment, roosting and nesting systems in birds; management of pestiferous birds; conservation of predatory birds.

Unit II

Bio-ecology of rodents of agricultural importance, patterns of pest damage and assessment, burrowing pattern and habitat of rodents; management of pestiferous rodents.

Unit III

Bio-ecology of higher vertebrates of agricultural importance, patterns of damage and assessment, their habitat; management of pestiferous vertebrates.

Unit IV

Management strategies- physical (trapping, acoustics and visual), chemical (poisons, repellents, fumigants and anticoagulants), biological (predators, parasites), cropping practices, alteration of habitats, diversion baiting and other eco-friendly methods – Operational practices- baiting, equipment and educative programmes.

Practical

- Identification of important rodents, birds and other vertebrate pests of agriculture, food preference and hoarding;
- Social behaviour, damage assessment, field survey, population estimation, management strategies: preventive and curative methods.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Oral presentation by students on specified topics
- Class room quiz
- Student discussions

Learning outcome

- Students are expected to be well versed with vertebrate pest diversity, their nature of damage, life history traits, behaviour and effective management.

Suggested Reading

Ali S. 1965. *The Book of Indian Birds*. The Bombay Natural History Society, Bombay.
Fitzwater WD and Prakash I. 1989. *Handbook of Vertebrate Pest Control.* ICAR, New Delhi.
Prakash I and Ghosh PK. 1997. *Rodents in Indian Agriculture*. Vol. I. State of Art Scientific Publ., Jodhpur.
Prakash I and Ghosh RP. 1987. *Management of Rodent Pests.* ICAR, New Delhi.
Prater SH. 1971. *The Book of Indian Animals*. The Bombay Natural History Society, Bombay.
Rahman A. 2020. *Protective and Productive Entomology* Narendra Publishing House, New Delhi

ENT 515: Techniques in Plant Protection 1 (0+1)

Aim of the course

To acquaint the students with appropriate use of plant protection equipment and techniques related to microscopy, computation, pest forecasting, etc.

Practical

- Pest control equipment, principles, operation, maintenance, selection, and application of pesticides;
- Release of bio-control agents;
- Seed dressing, soaking, root-dip treatment, dusting, spraying, and pesticide application through irrigation water;
- Application of drones in plant protection;
- Soil sterilization, solarization, deep ploughing, flooding, techniques to check the spread of pests through seed, bulbs, corms, cuttings and cut flowers;
- Uses of light, transmission and scanning electron microscopy;
- Protein isolation from the pest and host plant and its quantification using spectrophotometer and molecular weight determination using SDS/ PAGE;
- Use of tissue culture techniques in plant protection;
- Computer application for predicting/ forecasting pest attack and identification.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Experimentation
- Oral presentation by students on specified topics
- Class room quiz
- Student discussions

Learning outcome

- Students are expected to have a good knowledge of different plant protection equipments and techniques related to pest forecasting.

Suggested Reading

Alford DV. 1999. *A Textbook of Agricultural Entomology.* Blackwell Science, London.
Crampton JM and Eggleston P. 1992. *Insect Molecular Science.* Academic Press, London.

ENT 516: Apiculture 3 (2+1)

Aim of the course

To impart knowledge about the honey bees, and their behaviour and activities; bee husbandry, bee multiplication, bee enemies and diseases and their management; hive products, apitherapy; and managed bee pollination of crops

Theory

Unit I

Historical development of apiculture at global level and in India; Classification of bees; global distribution of genus *Apis* and races; Morphology and anatomy of honey bee; Honey bee biology, ecology, adaptations; Honey bee behaviour – nest founding, comb construction, brood care, defence, other in-house and foraging activities; Bee pheromones; Honey bee communication. Commercial beekeeping as an enterprise; Design and use of bee hives; Apicultural equipment; Seasonal bee husbandry; Honey bee nutrition and artificial diets; Absconding, swarming, drifting – causes and management; Curbing drone rearing; Laying worker menace – causes, signs and management.

Unit II

Bee genetics; Principles and procedures of bee breeding; Screening of honey bee colonies; Techniques in mass queen bee rearing; Mating nuclei and their establishment; Selective mating; Queen bee management; Bee packages.

Unit III

Ectoparasitic and endoparasitic bee mites – biology, ecology, nature and symptoms of damage, management tactics; Wax moths, wasps and ants – biology, ecology, nature and symptoms of damage, management tactics; Predatory birds, their damage potential and management tactics; Pesticide poisoning to honey bees, signs and protection; Protocols in evaluation of pesticide toxicity to honey bees.

Unit IV

Honey – composition, properties, crystallization, post-harvest handling and processing; Honey quality standards and assessment; Apicultural diversification – potential and profitability; Production/ collection of bee pollen, propolis, royal jelly, bee venom and bees wax and their post-harvest handling; Apitherapy; Value addition of hive products; Development of apiculture project. Non-*Apis* pollinators, their augmentation and conservation; Role of bee pollinators in augmenting crop productivity; Managed bee pollination of crops.

Practical

- Morphological characteristics of honey bee;
- Mouthparts; digestive, respiratory and reproductive adaptations in different castes of honey bees;
- Recording of colony performance;
- Seasonal bee husbandry practices;
- Swarming, queenlessness, swarming, laying workers menaces, etc. and their remedies;
- Innovative techniques in mass queen bee rearing; selection and breeding of honey bees;
- Instrumental insemination; formulation of artificial diets and their feeding;
- Production technologies for various hive products;
- Bee enemies and diseases and their management;
- Recording pollination efficiency;
- Application of various models for determining pollination requirement of crop;
- Developing a beekeeping project.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits and Observations
- Student discussions

Learning outcome

- Students are expected to have a comprehensive knowledge of bee biology, physiology and bee keeping/ apiculture.
- With practical training it is expected that students develop entrepreneurial skills for apiculture.

Suggested Reading

Abrol DP and Sharma D. 2009. *Honey Bee Mites and Their Management.* Kalyani Publishers, New Delhi, India.

Abrol DP. 2009. *Honey bee Diseases and Their Management*. Kalyani Publishers, New Delhi, India.

Abrol DP. 2010. *Beekeeping: A Compressive Guide to Bees and Beekeeping*. Scientific Publishers, India.

Abrol DP. 2010. *Bees and Beekeeping in India*. Kalyani Publishers, New Delhi, India.

Abrol DP. 2012. *Pollination Biology: Biodiversity Conservation and Agricultural Production.* Springer.

Atwal AS. 2001. *World of Honey Bees.* Kalyani Publishers, New Delhi- Ludhiana, India.

Atwal AS. 2000. *Essentials of Beekeeping and Pollination*. Kalyani Publishers, New Delhi-Ludhiana, India.

Bailey L and Ball BV. 1991. *Honey Bee Pathology*. Academic Press, London.

Crane Eva and Walker Penelope. 1983. *The Impact of Pest Management on Bees and Pollination.* Tropical Development and Research and Institute, London.
Free JB. 1987. *Pheromones of Social Bees.* Chapman and Hall, London.
Gatoria GS, Gupta JK, Thakur RK and Singh Jaspal. 2011. *Mass Multiplication of Honey Bee Colonies.* ICAR, New Delhi, India.
Grahm Joe M. 1992. *Hive and the Honey Bee.* Dadant & Sons, Hamilton, Illinois, USA.
Grout RA. 1975. *Hive and the Honey Bee.* Dadant & Sons, Hamilton, Illinois, USA.
Holm E. 1995. *Queen Rearing Genetics and Breeding of Honey Bees.* Gedved, Denmark.
Laidlaw HH Jr and Eckert JE. 1962. *Queen Rearing*. Berkeley, University of California Press.
Laidlaw HH. 1979. *Contemporary Queen Rearing.* Dadant & Sons, Hamilton, Illinois, USA.
Mishra RC. 2002. *Perspectives in Indian Apiculture*. Agro-Botanica, Jodhpur, India.
Mishra RC. 1995. *Honey Bees and their Management in India.* I.C.A.R., New Delhi, India.
Morse AA. 1978. *Honey Bee Pests, Predators and Diseases*. Cornell University Press, Ithaca and London.
Rahman, A. 2017. *Apiculture in India*, ICAR, New Delhi
Ribbands CR. 1953. *The Behaviour and Social Life of Honey Bees*. Bee Research Association Ltd., London, UK.
Rinderer TE. 1986. *Bee Genetics and Breeding.* Academic Press, Orlando.
Sardar Singh. 1962. *Beekeeping in India*. I.C.A.R., New Delhi, India (Reprint: 1982).
Seeley TD. 1985. *Honey Bee Ecology*. Princeton University Press, 216 pp.
Snodgrass RE. 1925. *Anatomy and Physiology of the Honey Bee*. Mc Graw Hill Book Co., New York & London.
Snodgrass RE. 1956. *Anatomy of the Honey Bee*. Comstock Publishing Associates, Cornell Univ. Press, Ithaca, New York.

ENT 517: Sericulture 3 (2+1)

Aim of the Course

To familiarize the students with entrepreneurial opportunities in entomology, sericulture in particular, and providing information on silk worm rearing, production and management.

Theory

Unit I

History of Sericulture, importance, organizations involved in sericulture activities, silkworm types, distribution, area and silk production.

Mulberry species, ecological requirements, cultivation, improved varieties, propagation methods, sapling production, planting and pruning techniques; pest and diseases, management strategies; intercropping, water and weed management. Food plants of eri silkworm, castor cultivation, intercultural operations, nutrient and water management; method of harvest; host plants of Tasar, nursery and cultivation, selection of seed, soaking and heap making, pruning techniques. Food plants of Muga silkworm, Som and Soalu propagation methods; nursery techniques; intercultural operations and weed management.

Unit II

Silkworm origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – pure races –multivoltine and bivoltine races – cross breeds – bivoltine hybrids – Races and hybrids of mulberry, eri, tasar and muga silkworm- Morphology and biology of silkworm, sex limited characters; anatomy of digestive and excretory systems of larva; structure and function of silk glands.

Unit III

Rearing house, types, disinfection, room and bed disinfectants; egg incubation methods, Chawki rearing, feeding, cleaning and spacing; rearing of late age worms, feeding, cleaning, spacing and moulting care; mountages, cocoon harvesting and marketing; pests and diseases of silkworms and their management.

Unit IV

Post cocoon technology, stifling, cocoon cooking, brushing, reeling, re-reeling, bleaching, degumming, dyeing, printing and weaving, different reeling machines; value addition in sericulture; economics of sericulture.

Practical

- Morphology of mulberry plants;
- Identification of popular mulberry genotypes;
- Nursery bed and main field preparation;
- Planting methods;

• Identification of nutrient deficiency symptoms;
• Identification of weeds;
• Pruning and harvesting methods;
• Identification of pests and diseases of mulberry–*Terminalia arjuna, Terminalia tomentosa,* Som and Soalu- Nursery and pruning techniques – Intercultural operations;
• Morphology of silkworm – Identification of races – Dissection of mouth parts and silk glands – Disinfection techniques – rearing facilities – silkworm rearing – feeding, cleaning and spacing – Identification of pests and diseases of mulberry silkworm – hyperparasitoids and mass multiplication techniques – silkworm egg production technology –Tasar, Eri and muga silkworms – rearing methods–pests and diseases of non-mulberry silkworms – Visit to grainage, cocoon market and silk reeling centre – Economics of silkworm rearing.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Actual rearing of Mulberry Silkworms
- Field visits to Mulberry gardens
- Visits to Mulberry chawky rearing centre and Cocoon Market
- Student discussions

Learning outcome

• Students taking up sericulture are expected to have a thorough knowledge of silkworm morphology, races, biology, and all the practices of rearing for silk production.
• They should be well versed with the pests and diseases of silkworm and their management.
• With practical training it is expected that students develop entrepreneurial skills for sericulture or link up with industries to sell cocoons for silk production or guide farmers engaged in silk worm rearing/ sericulture.

Suggested Reading

Dandin SB and K Giridhar. 2014. Hand book of Sericulture Technologies. Central Silk Board, Bangalore, 423p.

Govindaiah G, VP, Sharma DD, Rajadurai S and Nishita V Naik. 2005. A text book on mulberry crop protection. Central Silk Board, Bangalore.450 p.

Jolly MS, Sen SK, Sonwalkar TN and Prasad GK. 1980. Non–mulberry Silks. FAO Agicultural Services Bulletin 29. Food and Agriculture Organization of the United Nations, Rome, 178 p.

Mahadevappa D, Halliyal VG, Shankar DG and Ravindra Bhandiwad. 2000. Mulberry Silk Reeling Technology. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi. 234 p.

Mohanty PK. 2003. Tropical wild cocoons of India. Daya Publications, Tri Nagar, New Delhi, 197 p.

Nataraju B, Sathyaprasad K, Manjunath D and Kumar A. 2005. Silkworm crop protection. CSB, Bangalore. 412 pp.

Rangaswami G, Narasimhanna MN, Kasiviswanathan K, Sastry CR and Jolly MS. 1976. Food Plants of non-mulberry silkworms. In: *Mulberry cultivation*. FAO Agricultural Services Bulletin. Vol.1, Chapter-13. Rome, Italy. 96 p.

Tribhuvan Singh and Saratchandra B. 2004. Principles and Techniques of silkworm seed production. Discovery publishing House, New Delhi, 360 pp.

E-resources

www.silkwormgenomics.org; www.silkboard.com; ww.silkgermplasm.com; www.csrtimys.res.in

ENT 518: Lac Culture 3 (2+1)

Aim of the course

To familiarize the students with entrepreneurial opportunities in entomology with an emphasis on lac culture in particular. To provide information on lac insect rearing, production and management.

Theory

Unit I

History of lac production; importance, potential of lac production in India; organizations involved in lac production activities; strains of lac insects and lac crops – distribution, area and production of different strains of lac Steps and operation of lac production; lac host plant species, ecological requirements, their cultivation; seasons of host plants, harvest time of host plants, rearing seasons; grouping of host trees, pruning methods, timing; lac host plant pests and diseases; management strategies.

Unit II

Basic morphology and taxonomy of lac insect, strains of lac insect and their characteristics; composition of lac; biology of lac insect, species diversity and distribution.

Unit III

Introduction, lac insect-host plant interaction; selection of brood lac, local practices, improved alternatives, coupe system; propagation of lac insects: natural self inoculation, artificial inoculation; inoculation process and duration; removal of phunki, harvesting of lac, immature harvesting, mature harvesting and time of harvesting. Predators and parasitoids of lac insect, hyperparasites, diseases and their management.

Unit IV

Lac production stages; factors affecting yield and quality of shellac. Pure stock of host plants (kusum, palas, ber, pigeonpea, semialata); alternative method; technology of brood preserving. Host-specific technologies – cultivation on specific host plants; integration of lac cultivation with agro-forestry and horticulture; socio-economic potential of lac; export-import of lac/ lac products; marketing of lac and its products. Lac processing and value addition; entrepreneurship development.

Practical

- Lac host cultivation and lac production practices;
- Equipments for lac production;
- Conventional and advanced methods;
- Coupe system of lac production;
- Cultivation of suitable host plants;
- Pruning of host trees;
- Herbarium of host plants;

• Strains of lac insects;
• Brood lac selection and treatment for pest management;
• Slide preparation of adult and immature stages;
• Inoculation of host tree;
• Identification of natural enemies of lac insect and their management;
• Molecular characterization of lac insect where possible;
• Harvesting;
• Process of manufacture of seed lac, shell lac from stick lac;
• Grading of seed lac and shellac;
• Marketing of lac products and by products.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Field visits Lac culture systems
- Student discussions

Learning outcome

• The students are expected to have good knowledge of lac host trees and their maintenance for lac production.
• It is expected that they should perfect the most suitable techniques for lac producton with a good knowledge about diseases and natural enemies of the lac insect.
• With practical training it is expected that students are able to guide landless labourers, who bring stick lac as forest produce.

Suggested Reading

David BV and Ramamurthy VV. 2011. *Elements of Economic Entomology*, 6th Edition, Namrutha Publications, Chennai.
Sharma KK and Ramani R. 2010. *Recent advances in lac culture*. ICAR-IINRG, Ranchi.

ENT 519: Molecular Approaches In Entomology 3 (2+1)

Aim of the course
To acquaint students the latest techniques used in molecular biology.

Theory
Unit I
Introduction to molecular biology, techniques used in molecular biology. DNA recombinant technology, identification of genes/ nucleotide sequences for traits of interest, techniques of interest in plants and microbes.

Unit II
Genes of interest in entomological research- marker genes for sex identification, peptides and neuropeptides, JH esterase, St toxins and venoms, chitinase, Plant derived enzyme inhibitors, protease inhibitors, trypsin inhibitors, á-amylase inhibitors, lectins, terpenes and terpenoids; genes of non-plant origin, *Bacillus thuringiensis* endotoxins, mode of action of cry genes, classification and properties, synthetic Bt toxin genes, Other toxin genes, genes derived from entomophagous viruses, transgenic plants for pest resistance.

Unit III
Genetically engineered microbes and parasitoids in biological control-Genetic engineering in baculoviruses and fungal biocontrol agents for greater efficacy against insect pests. Effects of transgenic plants on pest biology and development, resistance management strategies in transgenic crops, molecular mechanism of insecticide resistance.

Unit IV
Genetic-based methods for agricultural insect pest management-insect pest management through sterile insect technique and release of insects carrying a dominant lethal gene. Methods and application of insect transgenesis, transgenics in silkworm and honeybees. Molecular tools for taxonomy and phylogeny of insect pests, DNA-based diagnostics. Nano technology and its application.

Practical
- Isolation of DNA/ RNA;
- Agarose gel electrophoresis of DNA, quantification of DNA by spectrophotometric and agarose gel analysis, PCR amplification of mitochondrial cytochrome oxidase subunit I gene (cox1) and 16S rRNA gene, cloning of PCR amplicons in standard plasmid vectors for sequencing, confirmation of the insert, miniprep of recombinant plasmid DNA, BLAST analysis and multiple sequence alignment of the sequence with sequences already available in GenBank;
- Isolation of host plant proteins, SDS-PAGE of the isolated proteins.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Class room quiz
- Visits to specialised molecular biology laboratories- NBAIR, IIHR, UAS, CFTRI, etc.
- Student discussions

Learning outcome

• The students are expected to be well versed with the basic techniques used in molecular biology.

Suggested Reading

Bhattacharya TK, Kumar P and Sharma A. 2007. *Animal Biotechnology*. 1st Ed., Kalyani Publication, New Delhi.

Hagedon HH, Hilderbrand JG, Kidwell MG and Law JH. 1990. *Molecular Insect Science.* Plenum Press, New York.

Hoy MA. 2003. *Insect Molecular Genetics: An Introduction to Principles and Applications*. 2nd Ed. Academic Press, New York.

Oakeshott J and Whitten MA. 1994. *Molecular Approaches to Fundamental and Applied Entomology.* Springer Verlag.

Rechcigl JE and Rechcigl NA. 1998. *Biological and Biotechnological Control of Insect Pests.* Lewis Publ., North Carolina.

Roy U and Saxena V. 2007. *A Hand Book of Genetic Engineering*. 1st Ed., Kalyani Publishers, New Delhi.

Singh BD. 2008. *Biotechnology (Expanding Horizons)*. Kalyani Publishers, New Delhi.

Singh P. 2007. *Introductory to Biotechnology*. 2nd Ed. Kalyani Publishers, New Delhi.

X. e- Resources

https://www.oxitec.com/en/our-technology#about-our-technology- and papers there in.

ENT 520: Plant Quarantine, Bio-safety and Bio-security 2 (2+0)

Aim of the course

To acquaint the learners about the principles and the role of Plant Quarantine in containment of pests and diseases, plant quarantine regulations and set-up. Also, to facilitate students to have a good understanding of the aspects of biosafety and biosecurity.

Theory

Unit I

Definition of pest, pesticides and transgenics as per Govt. notification; relative importance; quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/ diseases and their status.

Unit II

Plant protection organization in India. Acts related to registration of pesticides and transgenics. Insecticide regulatory bodies, synthetic insecticides, bio-pesticides and pheromone registration procdures. History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control agents.

Unit III

Identification of pest/ disease free areas; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and other techniques to detect pest/ pathogen infestations; VHT and other safer techniques of disinfestation/ salvaging of infected material.

Unit IV

WTO regulations; non-tariff barriers; pest risk analysis, good laboratory practices for pesticide laboratories; pesticide industry; sanitary and phytosanitary measures. Global Positioning System (GPS) and Geographic Information System (GIS) for plant biosecurity, pest/ disease and epidemic management, strategies for combating risks and costs associated with agroterrorism event, mitigation planning, integrated approach for biosecurity. Biosafety, policies and regulatory mechanism, Cartagena Protocol on Biosafety and its implications, issues related to release of genetically modified crops.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Oral presentation by students on specified topics
- Class room quiz
- Student discussions

Learning outcome

• Students offering this course are expected to have a good knowledge of the rules and regulations of Plant Quarantine, WTO regulations, GAP, Sanitary and Phytosanitary measures.

Suggested Reading

Rajeev K and Mukherjee RC. 1996. *Role of Plant Quarantine in IPM*. Aditya Books.

Rhower GG. 1991. Regulatory Plant Pest Management. In: *Handbook of Pest Management in Agriculture*. 2nd Ed. Vol. II. (Ed. David Pimental), CRC Press.

Shukla A and Veda OP. 2007. *Introduction to Plant Quarantine*. Samay Prakashan, New Delhi.

ENT 521 Edible and Therapeutic Insects 2 (1+1)

Aim of the course

To create awareness and acquaint students about the contribution that insects make to ecosystems, diets, food security and livelihoods in developed and developing countries.

Theory

Unit I

Edible and therapeutic insects: the concept, definition, and importance. History and origin of insects as food, feed and medication; important insect species and insect products consumed.

Unit II

Edible insect ecology, conservation and management of edible insect resources; environmental opportunities of insect rearing. Insect farming: the concept, definitions, and rearing techniques.

Unit III

Nutritional composition and role of insects in food security.

Unit IV

Processing edible insects for food and feed. Food safety and preservation, edible insects for livelihood security.

Practical

- Survey and identification of edible and therapeutic insect species;
- Collection and preservation of edible and therapeutic insect specimens;
- Rearing techniques of edible insect species;
- Harvesting techniques of edible insects from natural environment;
- Analysis of proximate elemental composition, antioxidant and anti-nutritional properties and microbial aspects of preservation.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Actual rearing of edible Insects
- Local survey/Literature survey to identify local edible insects
- Student discussions

Learning outcome

• Students are expected to be aware of insects for edible and therapeutic use; their nutritional composition.

• Should know the techniques of farming and processing insects for human and animal consumption.

Suggested Reading

Halloran A, Flore R, Vantomme P and Roos N 2018. Edible insects in sustainable food systems. Springer Cham, pp. XVII, 479.

Van Huis A, Itterbeeck JK, Klunder H, Mertens E, Halloran A, Muir G and Vantomme. 2013. Edible insects: future prospects for food and feed security. Food and Agricultural Organization of the United Nations, Rome.

ENT 522: Medical and Veterinary Entomology 2 (1+1)

Aim of the course

To study the major insect, mite, and tick vectors of disease to man and animals. Students will learn to identify and understand the life cycles, morphology, and behavior of mosquitoes, ticks, mites, lice, fleas, and other disease vectors.

Theory

Unit I

Introduction to medical, veterinary and forensic entomology; Classification of Arthropod-borne diseases; Hematophagy, disease transmission and epidemiology; flies (Diptera) of medical and veterinary Importance; moth flies: Leishmaniasis and Bartonellosis; biting midges (Ceratapogonidae).

Unit II

Mosquito taxonomy, biology, and behavior; mosquito viruses: EEE, VEE, SLE, yellow fever, mosquito surveillance; malaria; horse flies, deer flies: EIA, anaplasmosis; muscid flies; Myiasis (Muscoidea); myiasis and louse flies; black flies of medical and veterinary Importance; filariasis: mansonellosis, onchocerciasis.

Unit III

Lice of medical and veterinary importance; rickettsial diseases: epidemic typhus, etc.; mites: rickettsial pox; mites and acariasis: mange, scabies, chiggers; spiders and scorpions; fleas (Siphonaptera) of medical and veterinary importance; plague and murine typhus.

Unit IV

Ticks of medical and veterinary importance; lyme disease, rocky mountain spotted fever, tularemia; true bugs (Hemiptera): kissing bugs and bedbugs; chagas disease; tsetse flies; Lepidoptera and Hymenoptera of medical and veterinary importance.

Practical

- Identification of arthropod Classes, Orders and Families of medical and veterinary importance;
- Collection, segregation, curing insect and arachnid specimens, their preservation;
- Management of insect and mite pests of medical and veterinary importance;
- Study of some practical aspects in forensic entomology.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Class room quiz
- Actual rearing of Insects to study changes in morphology
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

• Students are expected to identify the arthropods of medical and veterinary importance; identify the diseases transmitted by these arthropod vectors and suggest management options.

Suggested Reading

David BV and Ramamurthy VV. 2011. *Elements of Economic Entomology*, 6th Edition, Namrutha Publications, Chennai.

Gullan PJ and Cranston PS. 2010. *The Insects: An Outline of Entomology*. 4th Edition, Wiley-Blackwell, West Sussex, UK & New Jersey, US.

Mullen G and Durden L. 2018. *Medical and Veterinary Entomology*, 3rd Edition, Academic Press.

ENT 523 Forest Entomology 2 (1+1)

Aim of the course

To promote a more global theoretical understanding of pest population dynamics and the causes of forest insect outbreaks: covering pests of both natural forests and plantations, the diversity of tropical forest insects, their ecological functions, the concept of pests and the incidence of pests in natural forests, plantations and stored timber.

Theory

Unit I

Introduction to forestry in the tropics, tropical forests: characteristics and types of tropical forests, management of tropical forests and the problems in their management; plantation forestry: beginnings, expansion and current status. History of tropical forest entomology, diversity of forest insects: structural and functional diversity – the feeding guilds, concept of pests, ecology of insects in forest environment, concept and functioning of ecosystem, role of insects in ecosystem processes of tropical forests: insects as primary consumers, secondary and tertiary consumers, as decomposers, as food, pollinators and other ecological interactions.

Unit II

Insect pests in natural forests, general pest incidence, pest outbreaks: Lepidoptera, Coleoptera, Hemiptera, and Hymenoptera; insect pests in plantations, nursery pests, sapling pests, pests of older plantations and their impact; insect pests of stored timber, categories of wood destroying insects and their damage: termites and beetles.

Unit III

Population dynamics, characteristics of population growth, factors affecting population growth, principles governing population dynamics, types and causes of forest insect outbreaks; general issues in forest entomology: enemies' hypothesis, resource concentration hypothesis, pest evolution hypothesis; pest problems in plantations of indigenous *vs* exotic species; pest problems in monocultures *vs* mixed plantations.

Unit IV

Management of tropical forest insect pests, historical development and present status of tropical forest pest management, overview of pest management options: preventive measures, remedial measures; unique features of forest pest management; constraints to forest pest management in the tropics; guidelines for the practice of forest pest management in the tropics. Insect pests in plantations: Location-specific case studies.

Practical

- Collection, identification and preservation of important insect pest specimens of forest plants and some damage material;

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Field visits and Insect collections and preservations
- Student discussions

Learning outcome

Students would have learnt global theoretical understanding of pest population dynamics and the causes of forest insect outbreaks: covering pests of both natural forests and plantations, the diversity of tropical forest insects, their ecological functions, the concept of pests and the incidence of pests in natural forests, plantations and stored timber

Suggested Reading

Ignazio Graziosi, Mathias Tembo, Jean Kuate, Alice Muchugi, 2019. Pests and diseases of trees in Africa: A growing continental emergency,

Meeta Sharma, 2016. Insect pests of forestry plants and their management. *International Journal of Advanced Research* 4(8):2099-2116

Maxwell-Lefroy, H. (Harold), 1877-1925. Indian insect life : a manual of the insects of the plains (tropical India)

Fletcher, T. B. (1914). *Some South Indian Insects*. By Superintendent Government Press, Madras.

PATTERN OF QUESTION PAPER FOR THE THEORY EXAMINATION

M.Sc. (Agri.) in ENTOMOLOGY

(Semester Scheme - CBCS Pattern)

Time: 3 Hours Max. Marks: 70

Instructions: Answer all the questions.

SECTION – A: Define/explain ANY FIVE of the following: 5 x 2 = 10

(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)

1)

2)

3)

4)

5)

6)

7)

SECTION-B: Write short notes on ANY FOUR of the following: 4 x 5 = 20

(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)

8)

9)

10)

11)

12)

13)

SECTION-C: Explain in detail on ANY FOUR of the following: 4 x 10 = 40

(Questions from all the Units of the Syllabus by drawing minimum of one question form each unit)

14)

15)

16)

17)

18)

19)

Signature of the BOS Chairman

UNIVERSITY OF MYSORE

Crawford Hall, Vishwavidyanilaya Karya Soudha,
Mysuru, Karnataka - 570005

POST GRADUATE REGULATION & SYLLABUS
Specialized Progammes

FOR

M. Sc. (Agri.) in Genetics & Plant Breeding

Sampoorna International Institute of Agri. Sciences and Horticultural Technology

271/2, K.B. Doddi, Gram, Madapuri Doddi, Nidagatta Post, Maddur (tq), Mandya (Dist.)

2023-2024

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POST GRADUATE REGULATIONS 2023-2024

1. TITLE

The Academic Information and Regulations shall be called "University of Mysore Academic Information and Regulations governing **Post graduate Degree Programmes in Agriculture Subjects under Semester System of Specialised Programme**" to be offered by the Sampoorna International Institute of Agri. Science and Horticultural Technology in addition to the Academic Regulation of the University of Mysore. These shall be applicable for students admitted from the Academic year 2023-24 and onwards.

2. DEFINITIONS

2.1 Academic Year: An academic year is a period during which a cycle of study is completed. It shall consist of two Semesters. Dates of registration, commencement of Instructions, semester end examination and academic calendar shall be approved by the University of Mysore

2.2 Semester: A Semester shall consist of not less than 110 instructional days. The final examinations shall be completed in then extten working days.

2.3 Curriculum: A series of courses designed to provide learning opportunities to meet there quirements for a degree as per BSMA (Broad Subject Matter Area) norms of the Indian Council of Agriculture Research. Courses with 500 series are applicable for master's degree Programmes.

2.4 Course: A course is a unit of instruction or segment of subject matter as specified in course calendar to be covered in a semester. It has a specified number, title and credit hours.

2.5 Credit Hours (Course Credit): A measure of quantity of work done in a course. One credit represents one hour of lecture or 2 hours of laboratory or fieldwork per week through a semester.

2.6 Course Load: The number of credit hours a student can register in a semester. A student shall not register for more than 23 credits in a semester.

2.7 Grade Point of a Course: A measure of quality of work done in a course to meet the requirement in a semester. It is computed by dividing the percentage of marks obtained in a course by 10. It shall be expressed on a 10-point scale up to third decimal place. A grade point of 6.00 and above shall be considered as successful completion of the course.

2.8 Grade Point Average (GPA): It is a quotient of the total course credit points secured by a student in various courses registered divided by the course credits during that semester. It shall be corrected to the third decimal place.

2.9 Cumulative Grade Point Average (CGPA): It is the cumulative performance of a student in all the courses taken during all the preceding semesters. CGPA is computed by dividing the total credit points earned by a student in all the courses taken from the beginning of the first semester by the total number of credits completed up to the end of a specified semester. It shall be corrected to the third decimal place.

2.10 Overall Grade Point Average (OGPA): It is a measure of the overall performance of a student on completion of the degree programme. It is computed by dividing the total number of course credit points earned by a student over the semesters by the total number of credit hours and corrected to the third decimal place. A minimum of 7.00 OGPA is necessary for a pass for master's degree.

3. POST GRADUATE DEGREE PROGRAMMES

The following degree programmes are offered at the **Sampoorna International Institute of Agri. Science and Horticultural Technology**, under the aegis of the University of Mysore, Mysuru. The Post graduate programmes leading to MASTER'S DEGREE **M.Sc. (Agri.) in Genetics & Plant Breeding.**

4. MODE OF ADMISSION

Application for admissions will be notified by the Institution every year. Eligible and desiring students can apply in the prescribed form along with the copies of the necessary documents either online or offline as notified by the Institution from time to time. All post graduate students admitted tentatively after paying the prescribed fee notified by the institution and submission of the original documents to the Institution have to further register with the University of Mysore as per the norms by paying the prescribed fee. However, the admission will be valid only after the University of Mysore approves the candidacy of the students.

4.1 Criteria for admission

Indian Nationals with a four-year Basic degree in Agriculture, Horticulture, Sericulture, Forestry and /or related /allied Sciences with an Overall Grade Point Average of 6.00 (60 % Marks)in the basic degree are eligible to get the admission. The medium of instruction shall be in English. Criteria for admission shall be notified from time to time.

4.1.1 Indian Nationals with foreign degree, children of NRIs/Foreign Nationals with a similar or equivalent degree are also eligible to apply to the Institution for admission but are to be approved by the University of Mysore. On

selection, they have to pay the prescribed fee of the Institution and submit the original documents as required by the institution/University of Mysore notified from time to time.

Admission for the seats which are not reserved, shall be made strictly according to the merit as well as first come first serve basis as the course is self-financed. However, the allotment of the seat shall be determined as outlined below:

4.1.2 The admission of candidates is subject to the following conditions:

a) Seats being vacant.
b) Verification of original marks cards and other details furnished in the application.
c) Payment of prescribed fee to the SIIASHT be made on or before the notified date by the authorities of SIIASHT and the University of Mysore to that particular academic year, failing which the admission is liable to be cancelled and any amount paid is non-refundable.
d) Production of medical fitness certificate at the time of registration.
e) Submission of duly signed **Annexure – V (i)** Rules and Regulations, **Annexure V (ii)** & **V (iii)** Undertaking / Declaration, **Annexure – V (iv)** and **Annexure – V (v)**. Acceptance letter of Admission and **Annexure VI (i)** to **Annexure – VI (iv)**. Application form, Rules and Regulations with Undertaking of the Hostel for the hostelites of the SIIASHT are mandatory to be submitted by both the students and a responsible guardian or parent of the student.

5. RESIDENTIAL REQUIREMENTS

A minimum of TWO Academic years (FOUR semesters) shall ordinarily be required for the programme of course work, research, thesis preparation and examinations leading to the Master's Degree. However, the duration may be extended up to a maximum of EIGHT semesters. The institution has no provision to accommodate part time studentship.

5.1 During the entire degree programme, a student enrolled is expected to be a full-time student. As a consequence, he/she is not permitted to work during the two-year period of enrolment, except in research and teaching related works within the premises of the Institution.

5.2 All enrolled PG students shall, therefore, give the following undertaking at the time of registration for every semester till they complete their residential requirements:

I, ..., ID No .. …….. studying Master's degree in ……., hereby give the undertaking that I will be a fulltime student and will not work anywhere during the I/II Semester of the academic year ……..., failing which my admission be cancelled.

Date: Signature of the Student

(Forwarded by the Chairperson and PG Coordinator to the Dean)

5.3 Despite the above undertaking, if any PG student is found working outside the Institution during the period of registered semester, action will be taken to consider the specific semester as null and void. Therefore, the student may have to repeat the specific work registered for the semester.

6. TIME LIMIT FOR COMPLETION OF THE DEGREE

A candidate admitted to the Masters' degree programme may be declared qualified for the degree, provided the candidate completes all the prescribed requirements within EIGHT consecutive semesters from the date of admission irrespective of his / her registration, failing which the admission shall be deemed to have been cancelled.

7. MIGRATION CERTIFICATE

Candidates from other Universities should produce Migration Certificate within the completion of the first semester, failing which their admission will be cancelled.

8. REGISTRATION FOR THE FIRST SEMESTER

Candidates on receipt of admission notice from the Institution shall submit the original documents, pay the prescribed fee notified from time to time and register for the relevant courses in person on or before the last date specified, failing which they shall for feit their admission.

8.1 For those students who were admitted subsequently, attendance shall be counted from the date of their registration.

8.2 A student who registers for the first semester of the Academic Degree Programme should complete a minimum of SIX credit hours securing a grade point other than 'F'or'SA'(Shortage of Attendance) failing which his/her admission shall stand cancelled. This will not be applicable to re-admitted candidates.

8.3 However, in genuine cases of hospitalisation resulting in immobilisation, a student can be exempted from the above clause provided sufficient proof is produced. The genuineness of such cases shall be examined and considered by a committee consisting of Dean of the Institution, Coordinator of PG studies and a Senior Professor in the Department/Institution.

9. REGISTRATION FOR THE SECOND AND SUBSEQUENT SEMESTERS

9.1 Registration for second and subsequent semesters shall commence TWO weeks prior to the closure of the ongoing semester.

9.1.1 The students registering for the courses shall do so in person/notified mode and by producing the ID card for verification at the time of Registration. Only under unavoidable circumstances, a student may be permitted by the Dean of the Institution to register in absentia.

The last date for registration without penal fee shall be the FIRST day of the semester.

9.1.2 However, students are permitted to register up to SIX working days after the last date, on payment of prescribed penal fee notified from time to time for late registration. After the SIXTH working day, the Dean of the Institution may permit the student to register with in next SIX working days on genuine grounds and on payment of additional late fee notified from time to time.

9.1.3 The attendance shall be counted from the date of commencement of the semester, irrespective of the date of registration. In case of newly admitted students, attendance shall be calculated from the date of registration.

9.1.4 Any student failing to register for subsequent semester within the prescribed time shall be deemed to have discontinued during that semester. However, student shall provide necessary documentary evidence to the Dean along with representation for discontinuation and by producing NO-DUES CERTIFICATE from the Hostel, Library, Accounts section, Sports section, Stores Section and the Respective Department.

9.1.5 Students shall clear all the dues to the Hostel(s), Library, Accounts section, Sports section, Stores Section and the Respective Departments be for eregistration of every semester.

A student may be permitted to add an approved course after the registration, provided the total number of credits is within the prescribed limit.

9.1.6 Adding of the courses should be done with the written permission of the PG Coordinator within **15** working days from the date of commencement of the semester.

9.1.7 A student will be permitted to drop a course upto a period of FOUR weeks from the date of commencement of the semester on the recommendation of the PG Coordinator and the permission of the Dean of the Institution.

9.1.8 Master's. students submitting thesis after completion of FOUR semesters, shall register specifically for thesis submission by paying the prescribed fee as notified from time to time.

9.2 RE-REGISTRATION

A student who discontinues for a semester with prior permission of the institution/University can re-register during any subsequent semester not exceeding the limit of EIGHT semesters from the date of admission by paying the prescribed re-registration fee as notified from time to time along with other fees within the prescribed time limit

9.3 RE-ADMISSION

The students who fail to complete their degree programme within the prescribed maximum of EIGHT semesters will not be eligible to get their degree. However, such students can seek re-admission with the approval of the University of Mysore to the same degree programme, by following the normal admission procedure by paying the requisite fee of the Institution/University of Mysore as notified from time to time. Such students will get the benefit of transfer of credits and will be able to complete their pending requirements to get the degree.

9.4 TRANSFER OF CREDITS INRESPECT OF MASTER'S DEGREE STUDENTS.

If a Master's degree student, after getting admission in a particular discipline has successfully completed the supporting and common courses and subsequently joins for Master's degree in a different discipline, is eligible to get the transfer of credits of the supporting and common courses, with grade to which the student gets fresh admission provided the student has completed the course with grade point average of 7.00 and above out of 10.00. However the duration of the master's degree would be counted starting from the date of admission to the new degree programme. Further, "Transfer of Credits" earned from previous admission shall be mentioned in the transcript.

10. FEE

A student who enrolls for Post Graduate programme shall be required to pay the prescribed fee that would be notified from time to time by the Institution and the University of Mysore and announced at the beginning of each academic year.

TUITION AND OTHER FEE ONCE PAID WILL NOT BE REFUNDED.

10.1 Fee for second and subsequent semesters shall be as prescribed by the Institution and the University of Mysore time to time.

10.2 Caution money is refundable on successful completion of the degree programme for which a candidate is admitted or if admission is cancelled. The students can claim the caution money after furnishing the "No dues" certificate from all the concerned within SIX months after completion of the degree programme or cancellation of the admission.

10.3 Miscellaneous and other Fee for University enrolment, certificates, re-registration, convocation, thesis submission *etc*., shall be paid as prescribed by the Institution/University from time to time and is not liable to be refunded.

11. CREDIT REQUIREMENT FOR MASTER'S PROGRAMME

As a National Agenda, Indian Council of Agriculture Research, New Delhi, in its wisdom has developed very detailed structure of course work for Master's degree programmes in various disciplines related to Agriculture. At the SIIASHT, Master's programmes are therefore, designed to be fully in tune with the National Agenda. The details of course and credit requirements for the Master's programmes at the SIIASHT are as follows.

Table 11.1 DISTRIBUTION OF COURSE CREDIT REQUIREMENTS FOR MASTER'S PROGRAMMES:

Sl. No.	Course Type	No. of Credits
1	Major Courses	20
2	Minor Courses	08
3	Supporting Courses	06
4	Common Courses	05
5	Seminar	02
6	Qualifying Examination	02
7	Research	27
	Total	**70**

11.1 MAJOR COURSE :

Major courses are the courses of the respective Departments in which a master's Student is enrolled. These are considered as Core and Compulsory courses as decided by the Department. A minimum of 20 credits of Major courses should be completed by the student to be eligible to acquire the Degree.

11.2 MINOR COURSES:

Minor course is from the subject closely related to a Major Subject and a student shall be permitted to register only ONE course from the parent discipline to meet the credit requirement of Minor Courses. Rest of the credit requirement can be chosen from other disciplines or the listed supporting courses.

11.3 SUPPORTING COURSES:

Supporting courses are not related to the major subjects. It could be any subject considered relevant for student's research work are necessary for building his/her overall competence.

Table 11.2 THE FOLLOWING COURSES MAY BE OPTED UNDER THE SUPPORTING COURSES

Code	Course title	Credits
AST 501	Mathematics for applied sciences	2+0
AST 502	Statistical methods for applied sciences	3+1
AST 511	Experimental designs	2+1
AST 512	Basic sampling techniques	2+1
AST 521	Applied regression analysis	2+1
AST 522	Data analysis using statistical packages	2+1
MCA 501	Computers fundamentals and programming	2+1
MCA 502	Computer organization and architecture	2+0
MCA 511	Introduction to communication technologies, computer networking and internet	1+1
MCA 512	Information technology in agriculture	2+0
BCM 501	Basic biochemistry	3+1
BCM 505	Techniques in biochemistry	2+2

11.4. Common Courses :

The following courses of one credit each will be offered to all the students undergoing master's degree programme which can be combination of online and offline as identified by the institution.

Table: 11.3 Common courses for Master's Degree progamme

Sl. No.	Course Code	Course Title	Credit Hours
1	CMC501	Library And Information Services	0+1
2	CMC502	Technical Writing and communication skills	0+1
3	CMC503	Intellectual Property and its Management in Agriculture	1+0
4	CMC504	Basic Concepts in Laboratory Techniques	0+1
5	CMC505	Agricultural Research, Ethics and Rural Development Programmes	1+0

11.5 ADDITIONAL COURSES

Based on the specific requirement related to the research topic of a student, the Advisory committee can recommend ONE or TWO additional courses. The additional courses can be of any department being offered at the SIIASHT. Course load of not exceeding THREE credit hours is permitted to be registered under additional courses that are approved by the advisory committee. However, these courses are considered as non-load courses and are not counted for calculation of CGPA/OGPA, but he/she has to undergo regular evaluation process.

12. PERMISSIBLE WORK LOAD

A Master's postgraduate student may register up to a maximum of **23** credit hours in a semester (excluding non-credit courses) on the recommendation of the Major Advisor / PG Coordinator.

Seminars can only be registered during the SECOND year with a maximum of ONE credit per semester.

12.1 DISTRIBUTION OF COURSES BY SEMESTER

At the SIIASHT, Schedule of course loads for all the FOUR semesters of a master's degree programme will be decided by the respective department /institution.

13. ATTENDANCE

The students are required to attend a minimum of **80** percent of the total number of lectures and practicals in each course. If a student falls short of the required attendance to an extent of TEN percent or less in any given course, the shortage may be condoned by the Dean on the recommendation of the course teacher and the PG Coordinator, on the condition that the shortage was due to unavoidable circumstances. Further, such a condonement of the attendance entails penal fee for each course separately to be paid by the student notified from time to time.

Attendance should be credited to the students who represent the University/ College in sports/cultural/literary events, etc., on recommendation of the PG Coordinator with the approval of the Dean, by providing documentary evidence.

13.1 The grade point of a student who does not meet the attendance requirement in a course (including Seminar and Research) shall be indicated as "SA" (SA-Shortage of Attendance). Such students have to re-register and complete the concerned course in subsequent semester AS AND WHEN IT IS OFFERED.

13.2 All Post graduate students enrolled are expected to sign every working day of the Institution in the prescribed Departmental Attendance Register. Those students who have registered for research and conducting their research in an institution or organization other than SIIASHT shall submit a document of attendance on monthly basis from the Major Advisor or Co-Advisor so designated of the respective Orgnisation/Institution.

14. ADVISORY COMMITTEE

An advisory committee will be constituted for every PG student with Major Advisor as the Chairperson, who is a recognized PG teacher in the concerned discipline.

A Major Advisor can be from the Sampoorna International Institute of Agri. Science and Horticultural Technology or from any other institution or Organisation affiliated to the University of Mysore or other State or National level Educational/Research Institution or an Organisation concerned to Agriculture and allied fields.

14.1 If a Major Advisor is from an institution other than the SIIASHT, then a Co-Advisor is appointed from the SIIASHT, who would take the responsibility of the student research and other academic activities at the Institution level.

Alternatively, Major Advisor can be from the SIIASHT and a Co-Advisor can be from the Institution /organization where the student would be permitted to conduct the research.

14.2 The Advisory Committee of a Master's degree student shall consist of three members among whom two members including the Chairperson are from major discipline and one from the supporting discipline.If the Major Advisor is not from the SIIASHT, then the committee would be of four members including the Co-Advisor.

Further, if the Major Advisor feels the need for an additional member, it can be permitted limiting the number of the committee to four members.

14.3 The PG Coordinator shall submit the proposal for the constitution of Advisory Committee (Form–1) of the student to the Dean of the institution for approval. This shall be completed before the closure of the first semester.

14.4 The Major Advisor shall submit the Plan of Work and Programme of Research (Form-2) as approved by the advisory committee to the Dean through PG Coordinator for approval before the end of the second semester.

All the members shall compulsorily attend the Advisory Committee meetings. However, under unavoidable circumstances one of the members other than the Chairperson may be absent.

15. QUALIFICATION OF THE MAJOR ADVISOR

A faculty member, with a Ph.D. in the concerned subject or with an M.Sc. (Agri.) degree and FOUR years of Teaching/ Research/ and /or Extension is eligible to serve as Major Advisor.

Similarly, any member of the faculty of respective department can serve as the member of the Advisory Committee.

15.1 EXAMINATION AND EVALUATION

Teachers shall be responsible for judging and grading the students' performance in each of the courses registered by the student through a system of examination.

15.1.1 The performance of the student in a course shall be graded on a ten-point scale up to three decimal points.

15.1.2 A student obtaining a grade point of lessthan 6.00 shall be declared as 'Failed' (F) in that course. A student who obtains 'F' or 'SA' grade in courses shall repeat that course when it is offered again by paying prescribed fee for re-registration as notified by the institution from time to time.

15.1.3 In the event of a student getting an 'F' or 'SA' grade in a particular non-core course (non-Major), he may be permitted by the Dean of the Institution on the advice of the Advisory Committee to register for an alternative course to facilitate the student's chances of timely completion of the degree programme. However, such alternative courses may be limited to a maximum of two non-major courses during the entire degree programme.

For computing the GPA and CGPA, "F" or "SA" grades shall be considered as zero.

In each course, total marks shall be a maximum of 100 marks for the purpose of grading.

Table: 15.1 Shows the actual maximum marks for the conduct of the examinations would be as indicated below.

Particulars	Courses with Theory and Practical Component Marks	Courses with only Theory Component Marks	Courses with only Practical Component Marks
I Examination (C1)	15	15	15
II Examination (C2)	15	15	15
Final Examination(C3)	70	70	70
Practical Examination, Practical Records, Assignments, *etc.*(C3)	70		-
Total	**170**	**100**	**100**

15.1.4 Both C1 and C2 Components are Internal Examinations that will be conducted by the course teacher and monitored by the PG Coordinator. The Final Theory Component (C3) would be an External Examination to be conducted by the University of Mysore and strictly monitored by the University of Mysore, Mysuru. Practical examination would be conducted by the course teacher with an external examiner nominated by the PG Coordinator within the Institution and the examination would be monitored by the PG Coordinator.

15.2 Question paper pattern

The pattern of Final written examination will be as indicated below:
Part A – Each paper consists of 20 MCQs of one mark each
Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions

15.3 Evaluation of Internals

15.3.1 Courses with both Theory and Practical Components:

This will be based on test, assignment, presentation. The first component of C1 conducted during 1st half of the semester, the first 50% of the syllabus (Unit 1 & unit 2) will be completed and the second component C2 during second half of the semester the remaining units (unit 3 & unit 4) of the syllabus will be completed, both C1 and C2 will have the both L + P courses.

15.3.1.1 The distribution of marks for both component C1 & C2 are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (2)

C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)

C2 = (3) + (4)

15.3.1.2 Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

15.3.1.3 Practical Examination will be for 70 marks that is split as follows:
Actual Practical Examination that includes written component: 50.00 marks
Practical Record: 10.00 and
Assignment/Viva: 10.00

15.3.1.4 The Final External theory exam and the practical exam marks is computed as follows
Let L = no. of credit hours for theory
P = no. of credits hours for practical
If X is the marks obtained by a student in theory exam and
Y is the marks obtained by the same student in practical examination, then the marks computed, M would be
$M = (L * X + P * Y)/ (L + P)$

Example for calculation of GPA for a student with both theory and Practical components.
Let L= 2 credits and X = 55
P = 1 credit and Y = 65
Then, M = ((2 * 55) + (1 * 65)) / (2 + 1) = (110 + 65)/3= 175/3 = 58.33 that would be rounded of to 58.00 marks.
If the student, in addition, has secured 7 and 9 marks in C1 and C2 respectively, then the total marks would be = 58.00 + 7.00 + 9.00 = 74.00

Therefore, the student will have a GPA of 7.4 for the specific course.

15.3.2 Courses with both only Theory Component P=0:

The distribution of marks for both component C1 & C2 in courses with only theory are as follows:

Written examination Part: 10.00 marks for unit1 & unit2 ----- (1)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ----(2)
C1 = (1) + (2)

Written examination Part: 10.00 marks for unit3 & unit4 ----- (3)
Assignment/ CLIP test/ Presentation/ Viva/ etc., as decided by the teacher
5.00 marks ---- (4)
C2 = (3) + (4)
Final Component assessment C3 examination will be for 70 marks as mentioned below:
Written External Examination: 70.00

The total adds up to 100.00 marks.

15.3.3 Courses with both only Practical Component L=0:

The distribution of marks for both component C1 & C2 in courses with only practical are as follows:

Conduct of an experiment or written exam:10.00 ------- (1)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(2)
C1 = (1) + (2)

Conduct of an experiment or written exam:10.00 ------- (3)
Assignment/ Practical Record/Viva/ etc.: 5.00 ----------(4)
C2 = (3) + (4)

Final Component assessment C3 examination that may include written component also: 50.00 marks.

Practical Record: 10.00 and
Assignment/Viva: 10.00
The total adds up to 100.00 marks.

15.4 The schedule of examinations in each course shall be notified by the respective PG Coordinator for the internal examinations. The schedule for the Final theory examinations will be by the University of Mysore. The first Component in each course will be conducted between 7^{th} and 8^{th} week and the second examination between 13^{th} and 14^{th} week. Practical examinations will be conducted during the last week of instructional days. The final theory examination will be conducted after 110 instructional days but with in the next 10 working days.

15.5 The student shall complete all the approved courses with an Overall Grade Point Average (OGPA) of not less than 7.00 out of 10.00 to be eligible for the award of the master's degree within the residential period.

15.6 In case a student fails to secure the minimum OGPA, the student will be permitted to repeat those courses in which the student has secured a grade point below 7.00 in Masters' degree, provided he/she registers the course by paying the prescribed fee notified by the institution from time to time. The grade point of the course repeated shall be considered for computing the OGPA.

15.7 Missed examination.

A student representing the College / University in sports / cultural / literary activities etc., will be provided the attendance and examination which the student has missed with the approval of the PG Coordinator and the Dean of the Institution. Such students are exempted from missed examination fees.

15.7.1 Students who miss any internal examination in a course due to hospitalization/death of parent/ own marriage/ attending interview/attending court cases, may be permitted by the PG Coordinator to appear for the missed examination on their commendation of the course teacher by paying the prescribed fee notified by the institution from time to time for each of the missed examination. Further, a student is eligible to appear for only one missed examination in a course in a semester.

15.7.2 The missed examination shall be conducted within 15 days from the date of missing the internal examination. The course teacher shall notify the date of missed examination and the students failing to take the missed examination on the notified date by paying a prescribed notified fees and time will have no further claim for another examination. Whereas the regulations prescribed for missed examination in a course shall not be applicable for final examination of each course

15.7.3 In case of missing an examination on medical grounds, a certificate from a government Medical Practitioner should be produced. Students staying at the campus in the College Hostel should produce the medical certificate issued from the designated Medical Officer.

A student may appeal to the Dean for redressal of grievances relating to the appearance for the missed examination.

The regulations prescribed for missed examination shall not be applicable for comprehensive written qualifying examination conducted by the university of Mysore in Masters' programmes.

16. SUBMISSION OF GRADE REPORTS

16.1 The evaluated answer papers of internal examinations shall be returned to the students only after the finalization of the grades by the University.

16.2 A student should fulfill all the requirements for the completion of course, failing which the grade point will be finalized based on the marks secured.

The PG Coordinator shall evaluate the Attendance percentage of all the students in the different Courses and send the same to the examination section of the University of Mysore after notifying the same to the respective students to determine the eligibility to take the Final Examination in each course. The Attendance Report and internal examination marks should reach the Examination section of the University of Mysore on or within the scheduled date as announced in the University notification.

16.3 A Grade point card of a student will be prepared for each semester based on the marks secured by the student by the University of Mysore and Transmitted to the College for further documentation and onward transmission to the student.

17. QUALIFYING EXAMINATION

17.1 A student is eligible to register for qualifying examination on completion of 75 percent of approved courses including 20 credits of major courses, excluding research and seminar. Separate Registration for qualifying examination should be completed by paying the prescribed fees within eight weeks from the commencement of the semester with the approval from the PG Coordinator.

17.2 The qualifying examination will carry TWO credits and shall consist of two parts:

17.2.1 Written examination for 150 marks covering 20 credits of core courses. 75 marks each for PAPER I and PAPER II Paper patterns:

Part A – Each paper consists of 25 MCQs of one mark each and the question paper shall not be returned.

Part B – Answering any 5 @ 2 marks each out of 7 questions +
Answering any 5 @ 3 marks each out of 7 questions +
Answering any 5 @ 5 marks each out of 7 questions
Courses for Paper I and Paper II will be notified by the PG Coordinator.
Each paper will be conducted for two and half hours.

17.2.2 *Viva-voce* for 50marks.

The University of Mysore shall conduct the written qualifying examination. Three sets of questions for each course will be developed and submitted by the individual course teachers to the PG Coordinator. Who in turn will develop a set of three papers each for the two examinations to be submitted to the University. The Chairman, BOS will choose one each finally for the two written examinations. Alternatively, the University will nominate an External Examiner for setting the question papers and evaluation of the answer scripts.

17.2.2.1 The *viva-voce* examination shall be conducted by the Advisor Committee with an external examiner designated by the University of Mysore. In a day *viva-voce* examination for a maximum of six students may be scheduled.

17.2.2.2 The external examiners shall be specialists in the major field from outside the Institution. The PG Coordinator will be the Chairperson of the Examination Committee and shall be responsible for communicating the results of the examination to the Dean of the Institution, who in turn will pass on the Results to the University of Mysore.

Not more than one member, other than the Chairperson and the External examiner, could be absent for the qualifying examination.

17.2.2.3 In special and emergency circumstances, when the Chairperson is unable to be present and conduct the qualifying examination, the Dean may designate, a Senior Professor to officiate as Chairperson to conduct the qualifying examination.

17.2.2.4 In special and emergency circumstances when not more than two members of the Advisory Committee are unable to be present and conduct the qualifying examination due to their hospitalization/out of head-quarter on official duty/ on long leave, the Dean may designate one of the faculty members to officiate as a member to conduct the qualifying examination.

17.2.2.5 The minimum requirement for a pass in the qualifying examination shall be a Grade Point of 7.000 (aggregate of written and viva voce examinations) with the stipulation that the student should obtain a minimum of 60 per cent in the written part of the qualifying examination to be eligible for *viva-voce* examination.

17.2.2.6 The qualifying examination will be conducted only once in an academic year. However, as a special case, the students who abstained or failed in the qualifying examination shall re-register for the same in the subsequent semester by paying the prescribed penal fee on the recommendation of the Major Advisor and PG Coordinator with the approval of the University of Mysore.

17.2.2.7 When a master's student has passed the qualifying examination; the student may be admitted to the candidacy of the degree. Formal intimation to this effect would be communicated to the student, Major Advisor and PG Coordinator by the University of Mysore on the basis of the recommendation of the Dean, SIIASHT.

18. SEMINARS AND COLLOQUIA

18.1 A PG teacher in the Institution will be designated as Teacher in charge of seminar course by the PG Coordinator. The student shall submit the topic of the seminar to the seminar teacher for approval. This minor teacher shall notify the topics and the schedule of the seminars within two weeks of the commencement of the semester.

18.2 The post graduate students stationed outside the SIIASHT for Research purpose who are not in a position to attend the seminars in the respective Departments, their participation in the seminars conducted in the respective institutions may be considered for purposes of counting the Attendance, if a regular seminar series exists in the concerned institution/organisation. If not, then the student has to mandatorily attend the seminars in the respective department. These conditions not with standing, the students should attend a minimum of 50 percent of seminars during the Semester in the Department and should give their own seminars in the respective Department. However, overall, 80 % attendance is must for completion of the Seminar course.

18.3 A student shall be permitted to register for seminar from second year of their admission and they will not be permitted to register for more than one seminar in a semester.

Table : 18.1 Evaluation of the seminar shall bed one by the teacher in-charge of the seminar and one additional faculty member as here under:

Sl. No	Description	Marks
1	Synopsis of the Seminar Topic	10.00
2	Presentation including Language, Introduction, Style and Clarity, Sequence and Organization, Topic Coverage	40.00
3	Effective use of Audio-Visual Aids	5.00
4	Time Management	5.00
5	Response to Questions during discussion	10.00
6	Report	30.00
	Total	100.00

In addition to fulfilling the seminar course requirement, each student shall present TWO colloquia related to the research topic first one prior to the submission of Form-2 and the second one after completion of research before circulation of thesis among the members of the advisory committee.

19. RESEARCH

19.1 The credits set aside for Research work for Post graduate Programme is distributed to different semesters. No student shall be permitted to register for Research credits until the approval of Plan of Work and Programme of Research (Form-2).

19.2 If the student does not submit the thesis during the last semester, 'IC' (Incomplete) grade shall be awarded for these research credits. The student shall re-register for these credits within the stipulated period for submission of the thesis.

19.3 Registration for submission of thesis beyond the prescribed period (four semesters for M.Sc.) may be done at any time during the stipulated time of (eight semesters from the date of admission of the student). The research credits registered for the PG degree programmes shall be graded as satisfactory/ not satisfactory after the submission of the progress report to the PG Co-Ordinator through the Major Advisor

20. THESIS SUBMISSION AND FINAL *VIVA-VOCE*

20.1 The student shall submit the thesis as per the guidelines issued by the Institution for **evaluation by the external examiner.**

20.2 Plagiarism

The student who submits the thesis for external has to provide the certificate of plagiarism issued by the University from time to time. The regulations issued through UGC notification on University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations Dtd. 23.07.2018 is applicable to the faculty and students regarding plagiarism. It is mandatory that each thesis submitted be verified for plagiarism and a certificate duly endorsed by the Major Advisor is to be provided by all the master's students.

20.3 The Masters' degree students before the submission of the thesis for external evaluation should compulsorily complete the poster presentation either at the PG Conference of the Institute or at any other scientific conference.

20.4 The thesis submitted in partial fulfilment of the Master's Degree shall be examined by the Advisory Committee and further evaluated by an External Examiner nominated by the Registrar (Evaluation), University of Mysore. The External Examiner shall be appointed by the Registrar (Evaluation) on the recommendation of the Major Advisor through the PG Coordinator, from a panel of three names in India but outside the University.

However, the Registrar (Evaluation) has the discretion of selecting an External Examiner from outside the Panel of specialists suggested. The External Examiner shalls end there port in the prescribed format along with the thesis to the Dean, SIIASHT with a copy of the report to the Registrar (Evaluation).

20.5 If the external examiner does not recommend the thesis for acceptance, the Registrar (Evaluation) may refer the thesis to the second examiner for evaluation on payment of a penal fee. If the second examiner recommends the thesis, the recommendation will be accepted. If the second examiner also does not recommend the thesis, the student shall have to re-write the thesis and re-submit the same after a lapse of one semester, by re-registering for thesis submission. If the thesis of the student is not accepted for the third time also, that thesis cannot be resubmitted. Under such circumstances, the student has to repeat the entire Research credits and work on a different thesis problem.

20.6 The final *viva-voce* examination will be held by the Advisory Committee within one month after the receipt of permission letter from the University to the PG Coordinator. However, under special circumstances the student is allowed to take final *viva-voce* within six months on payment of prescribed penal fee as prescribed by the Institution.

20.7 The Major Advisor shall be the Chairperson of the examination Committee. A designated teacher from within in the Institution will serve as the External Evaluator for the Final Viva-voce examination. External Evaluator for the Final Viva-voce would be appointed by the Dean, SIIASHT, on the recommendations of the PG Coordinator. Under special circumstances when the Chairperson of the Advisory Committee is unable to present and conduct the final *viva-voce*, the Co-Advisor or one of the Advisory Committee Members of the concerned Department can officiate as Chairperson on the recommendation of the PG Coordinator with the approval of the Dean. Further, when more than one member of the Advisory Committee are unable to be present and conduct the final *viva-voce* examination, due to their hospitalization/out of headquarters on official duty / on long leave, the PG Coordinator may designate any PG teacher to officiate on the request of the Major Advisor and HOD, as member to conduct the final *viva-voce*.

20.8 The Chairperson shall send the recommendations of the Advisory Committee to the PG Coordinator. Who in turn will transmit the same to the Registrar (Evaluation) of the University of Mysore, through the Chairman BOS, for the award of the Degree. All the concerned Forms ONE to SIX, will have been completed and submitted by the Institution to the Registrar (Evaluation), University of Mysore by this time, for the student to be eligible to get the Provisional degree Certificate.

20.9 The Thesis copies of the PG student should be type written and bound as specified by the University from time to time. Each student should submit three copies of the thesis and three CDs. Out of three copies of the thesis one each will be submitted to the Library, Department and to the University of Mysore. One CD will be placed in the library, and another will be submitted to the University of Mysore. A CD will also be submitted to the Major Advisor.

20.10 Incase of ICAR/Donor sponsored scholarship holders, a fourth copy of the Thesis along with CD should be submitted to the PG Coordinator for forwarding to ICAR/Donors.

20.11 The Thesis submitted by a student shall constitute the property of the Institution. Whenever an extract from the Thesis is published a foot note shall always have to be given indicating that the Thesis has been submitted for the post-graduate degree of the SIIASHT under the University of Mysore.

Copies of the Thesis deposited in the University Library or in the Departmental Libraries shall not be issued on loan, nor would these be available for reference, for a period of one year from the date of submission.

21. Regulations governing the conduct of Examinations and Prevention of Malpractices among students.

21.1 REGULATIONS GOVERNING THE CONDUCT OF EXAMINATIONS

21.1.1 The scheme of evaluation in each course shall be periodically notified by the University of Mysore.

21.1.2 It is the responsibility of the concerned course teacher to prepare the question paper and safe guard the secrecy.

21.1.3 The course teacher should ensure the prevention of malpractices in examinations. No student should be allowed to enter the examination hall later than 10 min. after the commencement of the exam. No electronic gadget will be allowed inside the examination hall, except when the course teacher permits.

21.1.4 When the teacher notices the student indulging in any malpractice, the teacher shall seize the paper from the student and shall in variably demand a written explanation or statement from the student.

21.1.5 If the student refuses to obey, the fact shall be duly noted and reported in writing to the Dean duly witnessed by another staff member. The teacher shall write remarks on the answer paper and affix the signature and send the candidate out of the hall. Such students shall not be allowed to take further examinations in that course during that semester.

21.1.6 All cases of malpractices should immediately be brought to the notice of the Dean concerned who shall send a report there on to the University authorities for such necessary action as may be deemed fit.

21.1.7 All cases of malpractices referred to the University authorities be examined by a committee set up by the University of Mysore. The decision of the Committee shall be final subject to review by theVice-Chancellor.

The committee may debar the guilty students for a period of one semester.

21.2 REGULATIONS GOVERNING THE PREVENTION OF MALPRACTICES AMONG STUDENTS

21.2.1 The students shall bear in mind that all the examinations under the semester system are University Examinations and should conduct accordingly.

21.2.2 No student shall enter the examination hall with papers, books or notes, electronic gadgets and such other material which might possibly be of assistance.

21.2.3 Any student indulging in malpractices during the examination shall be debarred for a period not less than one semester.

21.2.4. Any candidate found guilty of misconduct of a serious nature in the examination hall shall be debarred for a period of not less than two semesters.

21.2.5 Any candidate found guilty of an offence, shall give a written explanation or statement to the teacher or in-charge of the main examination hall if demanded. If the student refuses to give explanation or statement, student should record in writing for refusal to give such an explanation or statement.

21.2.6 Any candidate, who does not comply with the procedure indicated in the above said rule, may be deemed to have committed an offence shall bear consequent penalty.

21.3 REGULATIONS FOR THE MAINTENANCE OF DISCIPLINE AMONG THE STUDENTS

21.3.1 Every student of the SIIASHT shall conform to the rules of good conduct and respect the authority of the constituted bodies of the Institution and the University.

21.3.2 Every student of the Institution shall have a Student Identification Card with recent photograph affixed and signed by the concerned authority and shall be shown whenever it is demanded.

21.3.3 Students shall do everything possible to protect and make proper use of the Institution property and other public property. Any student who attempts to deface/destroy the Institution or other public property shall be liable for appropriate punishment. In addition, the cost of damage as assessed by the Institution caused by the students shall be recovered from the concerned Student after due examination by the Dean or a designated person by the Dean.

21.3.4 Proper decorum shall be maintained by all the students in the classroom, hostels, library, farms, educational and sports tours, transport vehicles and on & off the Campus of the Institution.

21.3.5 No student shall disturb the normal work of the Institution by disorderly conduct, boisterous behavior and unauthorized assembly.

21.3.6 Ragging in any form in the Institution premises is strictly prohibited. Students found guilty of ragging are liable for disciplinary action.

21.3.7 Every student shall be punctual to the classes. Class Teacher has the right to refuse admission to late-comers in the interest of class discipline.

21.3.8 Absenting to a class or examinations for whatever reason is considered as an act of indiscipline.

21.3.9 No student shall be in a class during the assigned hour unless the student has registered in that course. Students are not permitted to carry mobile phones during the class hours.

21.3.10 Possession or consumption of alcoholic drinks or drunkenness or drug addiction or gambling on the campus is strictly prohibited.

21.3.11 Violation of any one of the above regulations is an act of indiscipline and will be dealt by the Dean/Management or a person appointed by the Dean.

21.3.12 The Dean/Management shall enquire into the act of in discipline of the student(s) and the concerned shall take immediate action such as warning, fine and expulsion from Hostel and suspension from attending the classes for a period not exceeding one semester.

21.3.13 Further, in serious cases, disciplinary proceedings may be instituted through the Disciplinary Committee which can recommend punishment in the form of a warning/expulsion from the college for a semester/year.

21.3.14 Bonafide students will lose all those benefits from the University or from other Institutions with the University approval, if they are found to be involved in any of the acts of indiscipline.

21.3.15 Celebration of festivals on days other than authorized and unruly behaviour on such occasions will be considered as an act of indiscipline.

21.3.16 A student who has been found guilty by the Institution or the Disciplinary Committee and has been fined/suspended/expelled from the College or Hostel, shall not be permitted to hold any office, elected or otherwise, of student associations for a period of two years from the date of completion of the punishment.

21.3.17 If a student is taken into police custody on a criminal or other complaint for a period of 24hours or more, the student shall be deemed to have been suspended from the College for a period of one month from the date on which the student was taken into police custody without instituting an enquiry.

The decision of the Dean under all these Regulations shall be final.

22. CONVOCATION

22.1 The University shall confer degrees to all the students who complete their degree requirements in all respects in an academic year. However, at the time of taking their transcript and provisional degree certificate, they should fill in the convocation application and pay the prescribed fee and exercise their option whether they will be taking the degree in the Annual Convocation IN PERSON or IN ABSENTIA.

22.2 If a student has applied for a particular Convocation to take the degree 'In person' but fails to attend the Convocation, the student has to apply again by paying the penal fee in addition to the prescribed fee.

22.3 In case of death of a student before taking the degree at the Convocation, the nearest relative can apply for getting the degree at the Convocation. In such cases the University may consider confirming the degree on the candidate and award Gold Medals if any, posthumously.

23. REGULATION RELATING TO THE SCHEME OF HONOURING STUDENTS OF OUTSTANDING MERIT

A Gold Medal for each major subject at Master's. level shall be awarded to the students securing the highest Overall Grade Point Average with not less than 9.00 in the concerned Postgraduate degree together with a certificate of Merit. Two or more students getting the same OGPA will be awarded a Medal and a Certificate of Merit each, provided the OGPA is identical even to the fourth decimal. The Gold Medal and a Certificate of Merit shall be awarded at the time of Convocation. The value of each Gold Medal for each candidate will be the same.

The student shall complete all the formalities required for completion of the Degree programme on or before the last working day of the fourth semester from the date of admission of the student to be eligible to get any Medal.

However, the eligible candidate with the highest OGPA than the minimum requirement prescribed for the award of Gold medal will be issued a "Certificate of Merit".

24. DETERMINING CLASS/DISTINCTION

The following OGPA will be considered as equivalent to the Class/Division mentioned.

OGPA 9.00 & above	First Class with Distinction
OGPA 8.00 to 8.99	First Class
OGPA 7.00 to 7.99	Second Class for master's degree

POST GRADUATE FORMS

FORM 1

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B.Doddi, Maddur

Proposal for Constitution / Re-Constitution of Advisory Committee

The following members are proposed for the Constitution/Re-constitution of Advisory Committee in respect of Mr./Ms._____I.D. No._____admitted to Master's Programme in Entomology/Agronomy/Genetics & Plant Breeding during the year _____. The tentative title of his/her research programme is _____ _____ _____ _____ _____

Name and Designation		Address
1.		
2.		
3.		
4.		
5.		

Signature of the Chairperson

Forwarded to the Dean, SIIASHT in duplicate for approval and onward transmission to the University of Mysore, Mysuru..

Date **Signature PG Co-ordinator**

Forwarded to University of Mysore, Mysuru

Note: The form no. 1 should be submitted on or before twelveth week of the first semester

Date **Dean of SIIASHT**

Submitted for Approval and Notification to the **Registrar (Evaluation), University of Mysore**

Signature Chairman (BOS)

FORM 2

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

Plan of work & Programme of Research approved by the Advisory Committee

Date.....

The Advisory committee of Ms. /Mr.....
ID No. ..... admitted to Master's programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding met on ..... at ..... in ..... campus.

(*)1. The plan of work was considered.

2. The programme of research was considered.

3. The plan of work and programme of research were reviewed and the changes suggested are attached herewith.

4. Other issues considered.

Advisory Committee

	Name and Designation	**Signature**
1.	..... (Chairperson)	.....
2.	..... (Member)	.....
3.	..... (Member)	.....
4.	..... (Member)	.....
5.	..... (Member)	.....

Forwarded to the Dean, SIIASHT for information. And documentation and onward transmission to the University ofMysore.

Signature of PG Co- ordinator **Signature**
Major Advisor
Date .....

(*) Please strike off items not relevant

Plan of Work

5. Details of courses to be studied:

I Semester of the year .....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major Courses			Minor courses	
				Supporting Courses	
				Common Courses	
				Additional Courses	
	Total				
				Total	

Total credits.....

II Semester of the year.....

Course No.	Title	Credits	Course No.	Title	Credit Hours
	Major courses			Minor courses	
				Supporting Courses	
				Common Courses	
	Total			Additional Courses	
				Total	

Total credits.....

6. Total credits proposed for registration:

Sl. No.	Course Type	No. of Credits	
		Min. Required credits hours for Master's Programme	No. of credits hours completed
1	Major Courses	20	
2	Minor Courses	08	
3	Supporting Courses	06	
4	Common Courses	05	
5	Seminar	02	
6	Qualifying Examination	02	
7	Research	27	
	Total	**70**	

7. Tentative title of the research programme:

8. Additional information, if any:

Signature of Student **Signature of Chairperson**

Forwarded to the Dean, SIIASHT for approval.

Date..... **Signature of the PG Co- ordinator**

Programme of Research

1. Title of the research programme /topic:

2. Objectives:

3. Brief review of work:

4. Detailed programme of work:

5. Collaboration with other Departments /Institutions / Organisations and Fellow Scientists:

6. Salient features of the research work:

7. References:

Signature of the Student **Signature of theChairperson**

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean,
SIIASHT,
MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Approved

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 3

Report of the Examining Committee on the performance of the student in Qualifying Examination

Master's. degree programme majoring in ..... met on ..... at the Institute.

The qualifying examination, written as well as oral was conducted by the committee members. He/ She has passed / failed in the Examination.

He/ She has secured ..... marks out of..150 . in written and ..... marks out of .50 in oral examination. The grade point for qualifying examination is ..... out of..10.000.

Member's Present	**Signature**
1. ..... (Chairperson)	.....
2. ..... (Member)	.....
3. ..... (Member)	.....
4. ..... (Member)	.....
5. ..... (Member)	.....
6. ..... (Member)	.....

Members who could not attend

1. .....
2. .....

Submitted to Dean, SIIASHT,

Signature of the PG Co-ordinator

Forwarded to the University of Mysore, Mysuru for approval.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature
Chairman (BOS)

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 4

Proposal for Nomination of External Examiners for Thesis Evaluation

1. Ms. /Mr. ..... ID No.-..... admitted to M.Sc. (Agri.) degree programme during the year ..... and majoring in Entomology/Agronomy/Genetics & Plant Breeding has completed the course requirements and has passed in the qualifying examination.
2. Her/ his grade point average is .....
3. The title of Her/ his thesis is .....
4. Key words in thesis: .....
5. A panel of names of external examiners, with their addresses, land line and mobile phone numbers and E-mail ID, for evaluation of thesis is furnished here under (3 members for Master's degree programme).

1. .....

2. .....

3. .....

Signature of PG Co-ordinator **Signature of the Chairperson**

Date.....

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for approval.in duplicate for information and needful.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for Approval and Notification

Signature of Chairman (BOS)

1) Dr. .....is approved.

Date :

Registrar (Evaluation),
University of Mysore

SAMPOORNA INTERNATIONAL INSTITUTE OF AGRI. SCIENCE AND HORTICULTURAL TECHNOLOGY

K.B. Doddi, Maddur

FORM 5

Details of Courses and Submission of Thesis

1. Name of the student :
2. I.D. No :
3. Year of Admission :
4. Degree Programme :
5. Major Subject :
6. Thesis entitled : .....
   .....
   .....
7. List of Courses :

Course No.	Title of the Course / Seminar	Credit Hours	Grade Points Obtained
	A. Major courses completed		
	B. Minor courses completed		
	C. Supporting Courses		
	D. Common Courses		
	E. Qualifying Examination		
	F. Seminar completed		
	G. Additional Courses if any		

C. Colloquia presented

Sl. No.	Title of the Colloquium	Date of Presentation
1		
2		

8. Has the Plan of Work and Programme of Research been considered by the Advisory Committee and approved by **Registrar (Evaluation), University of Mysore**
9. Has changes, if any, in the Plan of Work and Programme of Research been recommended by the Advisory Committee and revised approval of **Registrar (Evaluation), University of Mysore** obtained:
10. Furnish details, if the Research topic has been changed.
    Topic of Research: .....
    Revised Topic of Research: .....
11. Has the student completed the total number of credits (Furnish the details).

No. of Credits registered	No. of Credits completed	Semester

12. Has the student submitted her / his thesis within the stipulated period of the PG programme.

Date of Registration for Thesis submission	Date of Submission of Thesis

13. Has the candidacy of the student been declared:

Signature of the Student

.

CERTIFICATE

Certified that the above requirements have been checked with reference to the student file and found correct.

Certified that the student has fulfilled all the requirements of credits for submission of thesis for External Evaluation.

Signature of the PG Co-ordinator **Signature of the Chairperson**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for onward transmission of the thesis submitted for evaluation by the External Evaluator.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

Signature
Chairman (BOS)

Transmitted under intimation to the Dean, SIIASHT,

Registrar (Evaluation)

FORM 6

Report of the Final Viva-Voce Examination

Date .....

The Examining Committee in respect of Ms., ID No. admitted to M.Sc. (Agri.) degree programme during the year and majoring in **Entomology** met on at **the SIIASHT.** .

The committee considered the report(s) of the External Examiner/s and..... on the thesis. The examiner hasrecommended the thesis for acceptance.

The final Viva-Voce examination was conducted by the Committee Members. The performance of the candidate was .....

Signature of the External Examiner

The committee recommends / does not recommend the approval of the thesis entitled **".....".**

Member's Present **Signature**

1. . (Chairperson) .....
2. .....(Member) .....

Members who could not attend

1. .....
2. .....

a) One hard copy and a soft copy of the thesis have been submitted to the Librarian, SIIASHT, Channapattana and a copy of the receipt is attached herewith.
b) One soft copy of the thesis has been submitted to the Major Advisor, SIIASHT, Channapattana.
c) One copy of the thesis submitted herewith to the Chairman, BOS for onward transmission to the University Library
d) The master's student has presented his / her thesis poster on

Date- **Signature of the Chairperson**

Forwarded to the Dean, SIIASHT, Channapattana in duplicate for further needful.

Date- **Signature of the PG Co-ordinator**

Forwarded to the Registrar (Evaluation), University of Mysore, Mysuru for with a request to issue the notification.

Dean, SIIASHT, MADDUR

Submitted to the **Registrar (Evaluation), University of Mysore,** for needful

SignatureChairman (BOS)

Notification Issued (To be issued within a week of the receipt of the request)

Registrar (Evaluation)
University of Mysore

Semester wise Distribution of Courses for M.Sc. (Agri.) in Genetics and Plant Breeding (GPB)

I YEAR					
SEMESTER - I					
Sl. No.	**Code**	**Course Title**	**Type**	**Credits**	**Total Credits**
1	CMC 501	Library and Information Services	Common	1	
2	CMC 502	Technical Writing and Communications Skills	Common	1	
3	CMC 504	Basic Concepts in Laboratory Techniques	Common	1	
Total Credits					**3**
4	AST 502	Statistical methods for applied sciences	Supporting	4	
Total Credits					**4**
5	GPB 501	Principles of Genetics	Major	3	
6	GPB 502	Principles of Plant Breeding	Major	3	
7	GPB 504	Varietal Development and Maintenance Breeding	Major	2	
8	GPB 505	Principles of Cytogenetics	Major	3	
Total Credits					**11**
9	MCA 512	Information technology in agriculture	Minor	2	
	Total Credits				**2**
TOTAL CREDITS FOR I SEMESTER					**20**
SEMESTER – II					
1	CMC 503	Intellectual Property and its management in Agriculture	Common	1	
2	CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	
	Total Credits				**2**
3	BCM 501	Basic biochemistry	Supporting	4	
Total Credits					**4**
4	GPB 503	Fundamentals of Quantitative Genetics	Major	3	
5	GPB 506	Molecular Breeding and Bioinformatics	Major	3	
6	GPB 511	Crop Breeding-I (Kharif Crops)	Major	3	
Total Credits					**9**
7	GPB 509	Hybrid Breeding	Minor	3	
8	AST 511	Experimental designs	Minor	3	
Total Credits					**6**
TOTAL CREDITS FOR II SEMESTER					**21**

II YEAR					
SEMESTER - III					
1	GPB 581	Qualifying Examination	QE	2	
2	GPB 591	Master's seminar I	Seminar	1	
3	GPB 599	Master's research	Research	13	
TOTAL CREDITS FOR III SEMESTER					**16**
SEMESTER - IV					
1	GPB 592	Master's seminar II	Seminar	1	
2	GPB 599	Master's research	Research	14	
TOTAL CREDITS FOR IV SEMESTER					**15**

SUMMARY OF CREDITS DISTRIBUTION FOR THE FOUR SEMESTERS

Sl. No.	Course Type	I Semester	II Semester	III Semester	IV Semester	Total No. of Credits
1	**Major Courses**	11	09			**20**
2	**Minor Courses**	02	06			**08**
3	**Supporting Courses**	04	04			**08**
4	**Common Courses**	03	02			**05**
5	**Seminar**	-	-	01	01	**02**
6	**Qualifying Examination**	-	-	02	-	**02**
7	**Research**	-	-	13	14	**27**
	Total	**20**	**21**	**16**	**15**	**72**

COMMON COURSES FOR M. Sc. (AGRI.) IN DIFFERENT DISCIPLINES

To be in tune with the BSMA norms of the ICAR, New Delhi, the following courses (one credit each) will be offered to all students undergoing Master's degree programme at SIIASHT, Maddur

Code	Course Title	Credits	Credit Pattern	Credit Value
CMC 501	Library and Information Services	1	0+1	1
CMC 502	Technical Writing and Communications Skills	1	0+1	1
CMC 503	Intellectual Property and its management in Agriculture	1	1+0	1
CMC 504	Basic Concepts in Laboratory Techniques	1	0+1	1
CMC 505	Agricultural Research, Research Ethics and Rural Development Programmes	1	1+0	1

Some of these courses are also available in the form of e-courses. The students are allowed to register for these courses/similar courses on these aspects, if available online on SWAYAM or any other platform with the permission of the PG Coordinator under intimation to the Chairman (BOS) and the Registrar (Evaluation).

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 Major Advisor and the PG Coordinator. However, the overall Credit requirement of a minimum of 05 credits through Common Courses are to be met by every Master's student registered at SIIASHT to meet the norms of the BSMA.

SYLLABUS OF COMMON COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

CMC 501 : LIBRARY AND INFORMATION SERVICES (0+1)

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information-Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations and illustrations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Richard E. Rubin. 1998. Foundations of Library and Information Science (Paperback)

Kay Ann Cassell and Uma Hiremath, 2006. Reference and Information Services in the 21st Century : An Introduction.

CMC 502: TECHNICAL WRITING AND COMMUNICATIONS SKILLS (0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical Technical Writing –

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

• Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
• Collins' Cobuild English Dictionary. 1995.
• Harper Collins. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed.
• Holt, Rinehart & Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
• James HS. 1994. Handbook for Technical Writing. NTC Business Books.
• Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East- West Press.
• Mohan K. 2005. Speaking English Effectively. MacMillan India.
• Richard WS. 1969. Technical Writing.
• Barnes & Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
• Abhishek. Sethi J &Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
• Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

CMC 503: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Erbisch FH &Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

CMC 504: BASIC CONCEPTS IN LABORATORY TECHNIQUES (0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
Gabb MH &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

CMC 505: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions;

UNIT II

Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT III

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT IV

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co- operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing)
- Class room observations
- Oral presentation by students on specified topics
- Student discussions

Suggested Readings

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
- Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
- Singh K.. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

ICAR, New Delhi, as per the norms of the BSMA has suggested the following courses to be offered by various disciplines (The list is only indicative) to meet the requirement of Supporting Courses. It is mandatory that a minimum of Six credits of supporting courses be completed by the Master's degree students in different disciplines. Based on the requirement, some of the following courses have been opted under the supporting courses. The syllabi of these courses are detailed below. At SIIASHT, Maddur, some of these courses are also suggested for Minor courses requirement.

Code	Course Title	Credits	Credit Pattern	Credit Value
AST 501	Mathematics for applied sciences	2	2+0	2
AST 502	Statistical methods for applied sciences	4	3+1	4
AST 511	Experimental designs	3	2+1	3
AST 512	Basic sampling techniques	3	2+1	3
AST 521	Applied regression analysis	3	2+1	3
AST 522	Data analysis using statistical packages	3	2+1	3
MCA 501	Computers fundamentals and programming	3	2+1	3
MCA 502	Computer organization and architecture	2	2+0	2
MCA 511	Introduction to communication technologies, computer networking and internet	2	1+1	2
MCA 512	Information technology in agriculture	2	1+1	2
BCM 501	Basic biochemistry	4	3+1	4
BCM 505	Techniques in biochemistry	4	2+2	4
	TOTAL		**35**	

SYLLABUS OF SUPPORTING COURSES FOR M. Sc. (Agri.) IN DIFFERENT DISCIPLINES

AST 501: Mathematics for Applied Sciences (2+0)

Aim of the course

This course is meant for students who do not have sufficient background of Mathematics. The students would be exposed to elementary mathematics that would prepare them to study their main courses that involve knowledge of Mathematics. The students would get an exposure to Linear Algebra, differentiation, integration and differential equations etc.

Theory

Unit I

Set theory-set operations, finite and infinite sets, operations of set, function.

Unit II

Vectors and vector spaces, Matrices notations and operations, laws of matrix algebra; transpose and inverse of matrix, Eigen values and Eigen vectors. Determinants -evaluation and properties of determinants, Solutions of Linear Equations.

Unit III

Variables and functions, limits and continuity of specific functions. Differentiation theorems of differentiation, differentiation of logarithmic, trigonometric, exponential and inverse functions, Differentiation of function of a function, derivatives of higher order, partial derivatives. Application of derivatives, determination of points of inflexion, maxima and minima.

Unit IV

Integration, methods of integration, reduction formulae, definite and indefinite integral, Applications of integration in Agriculture, Differential Equations.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Hohn FE. 2013. *Elementary Matrix Algebra*, 3rd Ed., Kindle Edition
• Harville D.A. 1997. *Matrix Algebra from a Statistician's Perspective*. Springer.
• Hohn F.E. 1973. *Elementary Matrix Algebra*. Macmillan.
• Searle S.R. 1982. *Matrix Algebra Useful for Statistics*. John Wiley.
• Stewart J. 2007. *Calculus*. Thompson.
• Thomas G.B. Jr. and Finney R.L. 1996. *Calculus.* 9th Ed. Pearson Edu.

AST 502: Statistical Methods for Applied Sciences (3+1)

Aim of the course

This course is meant for students who do not have sufficient background of Statistical Sciences: Agricultural Statistics Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Theory

Unit I

Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation.

Unit II

Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions.

Unit III

Introduction to theory of estimation and confidence-intervals, Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination, Fitting of quadratic models.

Unit IV

Non-parametric tests – sign, Wilcoxon, Mann-Whitney U-test, Run test for the randomness of a sequence. Median test. Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques, Introduction to Multivariate Analysis, Transformation of Data.

Practical

- Exploratory data analysis, fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal.
- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and Correlation and regression analysis, fitting of Linear and Quadratic Model.
- Non-parametric tests. ANOVA: One way, Two Way, SRS.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Goon A.M, Gupta M.K and Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
- Goon A.M, Gupta M.K. and Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
- Hoel P.G. 1971. *Introduction to Mathematical Statistics*. John Wiley.
- Hogg R.V and Craig T.T. 1978. *Introduction to Mathematical Statistics*. Macmillan.
- Morrison D.F. 1976. *Multivariate Statistical Methods*. McGraw Hill.
- Hogg RV, McKean JW, Craig AT. 2012. *Introduction to Mathematical Statistics* 7th Edition.
- Siegel S, Johan N & Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*. John Wiley.
- Anderson TW. 2009. *An Introduction to Multivariate Statistical Analysis*, 3rd Ed . John Wiley
- http://freestatistics.altervista.org/en/learning.php.
- http://www.statsoft.com/textbook/stathome.html.

AST 511: Experimental Designs (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Agricultural Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

Unit I

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

Unit II

Uniformity trials, size and shape of plots and blocks, Analysis of variance, Completely randomized design, randomized block design and Latin square design.

Unit III

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom. Concept of confounding.

Unit IV

Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined analysis.

Practical

- Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law, Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments,
- Analysis with missing data,
- Split plot and strip plot designs.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG and Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley.
- Dean AM and Voss D. 1999. *Design and Analysis of Experiments*. Springer.
- Montgomery DC. 2012. *Design and Analysis of Experiments*, 8th Ed. John Wiley.
- Federer WT. 1985. *Experimental Designs*. MacMillan.
- Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
- Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*. John Wiley.
- www.drs.icar.gov.in.

AST 512: Basic Sampling Techniques (2+1)

Aim of the course

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

Theory

Unit I

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

Unit II

Simple random sampling with and without replacement, sampling for proportion, determination of sample size, inverse sampling, Stratified sampling.

Unit III

Cluster sampling, Multi-stage sampling, systematic sampling; Introduction to PPS sampling,

Unit IV

Use of auxiliary information at estimation, Ratio product and regression estimators. Double Sampling, sampling and non-sampling errors.

VI. Practical

- Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.;
- Simple random sampling, determination of sample size, inverse sampling, stratified sampling, cluster sampling and systematic sampling;
- Estimation using ratio and regression estimators;
- Estimation using multistage design, double sampling.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cochran WG. 1977. *Sampling Techniques*. John Wiley.
- Murthy MN. 1977. *Sampling Theory and Methods*. 2nd Ed. Statistical Publ. Soc., Calcutta.
- Singh D, Singh P and Kumar P. 1982. *Handbook on Sampling Methods*. IASRI Publ.
- Sukhatme PV, Sukhatme BV, Sukhatme S and Asok C. 1984. *Sampling Theory of Surveys with Applications*. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.
- Cochran WG. 2007. *Sampling Techniques*, 3rd Edition. John Wiley & Sons Publication

AST 521: Applied Regression Analysis (2+1)

Aim of the course

This course is meant for students of all disciplines including agricultural and animal sciences. The students would be exposed to the concepts of correlation and regression. Emphasis will be laid on diagnostic measures such as autocorrelation, multi collinearity and heteroscedasticity. This course would prepare students to handle their data for analysis and interpretation.

Theory

Unit I

Introduction to correlation analysis and its measures, Correlation from grouped data, correlation, Rank correlation, Testing of population correlation coefficients; Multiple and partial correlation coefficients and their testing.

Unit II

Problem of correlated errors; Auto correlation; Heteroscedastic models, Durbin Watson Statistics; Removal of auto correlation by transformation; Analysis of collinear data; Detection and correction of multi collinearity, Regression analysis; Method of least squares for curve fitting; Testing of regression coefficients; Multiple and partial regressions.

Unit III

Diagnostic of multiple regression equation; Concept of weighted least squares; regression equation on grouped data; Various methods of selecting the best regression equation.

Unit IV

Concept of nonlinear regression and fitting of quadratic, exponential and power curves; Economic and optimal dose, Orthogonal polynomial.

Practical

- Correlation coefficient, various types of correlation coefficients, partial and multiple, testing of hypotheses;
- Multiple linear regression analysis, partial regression coefficients, testing of hypotheses, residuals and their applications in outlier detection;
- Handling of correlated errors, multi collinearity.
- Fitting of quadratic, exponential and power curves, fitting of orthogonal polynomials.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

VIII. Suggested Reading

- Kleinbaum DG, Kupper LL, Nizam A. 2007. *Applied Regression Analysis and Other Multivariable Methods* (Duxbury Applied) 4th Ed.
- Draper NR and Smith H. 1998. *Applied Regression Analysis*. 3rd Ed. John Wiley.
- Ezekiel M. 1963. *Methods of Correlation and Regression Analysis*. John Wiley.
- Koutsoyiannis A. 1978. *Theory of Econometrics*. MacMillan.
- Kutner MH, Nachtsheim CJ and Neter J. 2004. *Applied Linear Regression Models*. 4th Ed. With Student CD. McGraw Hill.

AST 522: Data Analysis Using Statistical Packages (2+1)

Aim of the course

This course is meant for exposing the students in the usage of various statistical packages for analysis of data. It would provide the students a hands on experience in the analysis of their research data. This course is useful to all disciplines.

Theory

Unit I

Introduction to various statistical packages: Excel, R, SAS, SPSS. Data Preparation; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

Unit II

Test for normality; Testing of hypothesis using chi-square, *t* and *F* statistics and Z-test.

Unit III

Data preparation for ANOVA and ANCOVA, Factorial Experiments, contrast analysis, multiple comparisons, Analyzing crossed and nested classified designs.

Unit IV

Analysis of mixed models; Estimation of variance components; Correlation and regression analysis, Probit, Logit and Tobit Models. Discriminant function; Factor analysis; Principal component analysis; Analysis of time series data, Fitting of non-linear models; Neural networks.

Practical

- Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data;
- Testing the hypothesis for one sample *t*-test, two sample *t*-test, paired *t*-test, test for large samples - Chi-squares test, F test, one-way analysis of variance;
- Designs for Factorial Experiments, fixed effect models, random effect models, mixed effect models, estimation of variance components;
- Linear regression, Multiple regression, Regression plots;
- Discriminant analysis - fitting of discriminant functions, identification of important variables;
- Factor analysis. Principal component analysis - obtaining principal component.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Anderson C.W. and Loynes R.M. 1987. *The Teaching of Practical Statistics*. John Wiley.
• Atkinson A.C. 1985. *Plots Transformations and Regression*. Oxford University Press.
• Chambers J.M., Cleveland W.S., Kleiner B and Tukey P.A. 1983. *Graphical Methods for Data Analysis*. Wadsworth, Belmount, California.
• Chatfield C. 1983. *Statistics for Technology*. 3rd Ed. Chapman & Hall. Chatfield C. 1995. *Problem Solving: A Statistician's Guide*. Chapman & Hall.
• Cleveland W.S. 1985. *The Elements of Graphing Data*. Wadsworth, Belmont, California.
• Ehrenberg ASC. 1982. *A Primer in Data Reduction*. John Wiley.
• Erickson B.H. and Nosanchuk T.A. 1992. *Understanding Data*. 2nd Ed. Open University Press, Milton Keynes.
• Snell E.J. and Simpson HR. 1991. *Applied Statistics: A Handbook of GENSTAT Analyses*. Chapman and Hall.
• Sprent P. 1993. *Applied Non-parametric Statistical Methods*. 2nd Ed. Chapman & Hall.
• Tufte ER. 1983. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Conn.
• Velleman PF and Hoaglin DC. 1981. *Application, Basics and Computing of Exploratory Data Analysis*. Duxbury Press.
• Weisberg S. 1985. *Applied Linear Regression*. John Wiley.
• Wetherill GB. 1982. *Elementary Statistical Methods*. Chapman & Hall.
• Wetherill GB.1986. *Regression Analysis with Applications*. Chapman & Hall.
• Cleveland WS. 1994. *The Elements of Graphing Data*, 2nd Ed., Chapman & Hall
• http://freestatistics.altervista.org/en/learning.php.
http://freestatistics.altervista.org/en/stat.php.
http://www.cas.lancs.ac.uk/glossary_v1.1/main.html.
http://www.stat.sc.edu/~grego/courses/stat706/.
• www.drs.icar.gov.in.

MCA 501: Computer Fundamentals and Programming (2+1)

Aim of the course

This is a course on Computer Fundamentals and Programming that aims at exposing the students to understand how computer works, analytical skills to solve problems using computers. And to write computer programs using C.

Theory

Unit I

Functional units of computer, I/O devices, primary and secondary memories. Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, Operator precedence, character representation; ASCII, Unicode.

Unit II

Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Constants and variables; Data types: integer, character, real, data types; Arithmetic expressions, assignment statements, logical expressions. Control flow

Unit III

Arrays and structures. Pointers, dynamic memory allocations

Unit IV

Program Structures – functions, subroutines. I/O operations, Program correctness; Debugging and testing of programs.

Practical

- Conversion of different number types;
- Creation of flow chart, conversion of algorithm/flowchart to program;
- Mathematical operators, operator precedence;
- Sequence, control and iteration;
- Arrays and string processing;
- Matrix operations, Sorting, Pointers and File processing – Reading and writing text files.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Balaguruswamy E. 2019. *Programming with ANSI C*. Tata McGraw Hill.
- Gottfried B. 2017. *Programming with C, Schaum Outline Series*. Tata McGraw Hill.
- Kanetkar Y. 1999. *Let Us C*. BPB Publ.
- Malvino A.P. and Brown J.A.. 2017. *Digital Computer Electronics*. Tata McGraw Hill.
- Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.

MCA 502: Computer Organization and Architecture (2+0)

Aim of the course

This is a course on Computer Organization and Architecture that aims at exposing the students to understand basic knowledge of how computer works.

Theory

Unit I

Number systems; Boolean algebra - minimization of Boolean function using Karnaugh Map.

Unit II

Logic Gates, Combinational circuits – multiplexer, de-multiplexer, encoder, decoder; Sequential circuits: Flip-flops, Half and Full adder, Shift register, Counters. Organization of CPU, Control Unit- Instruction and Execution cycle in CPU, Register Organization, The Instruction Cycle, Instruction Pipelining.

Unit III

Memory organization - Internal memory: Semiconductor Main Memory (RAM, ROM, EPROM), Cache Memory, Advanced DRAM Organization; External Memory - Magnetic Disks, RAID, Optical Memory, Magnetic Tape. Basic structure of computer hardware and system software - Addressing methods and machine programme sequencing; Input-output organizations - accessing I/O devices - direct memory access (DMA) – interrupts.

Unit IV

Introduction to microprocessors – CISC and RISC Architecture, Study of functional units of microprocessors.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Gear C.W. 1974. *Computer Organization and Programming*. McGraw Hill.
• Hayes J.P. 1988. *Computer Architecture and Organisation*. McGraw Hill.
• Malvino A.P and Brown J.A. 1999. *Digital Computer Electronics*. Tata McGraw Hill.
• Mano M.M. 1999. *Digital Logic and Computer Design*. Prentice Hall of India.
• Mano M.M. 2007. *Computer System Architecture*. Prentice Hall of India.
• Stallings W. 2016. *Computer Organization and Architecture: Designing for Performance*. Pearson Edu.

MCA 511: Introduction to Networking and Internet Applications (1+1)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand Computer networking and web applications development.

Theory

Unit I

Networking fundamentals, types of networking, network topology; Introduction to File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol (SMTP), Internet Protocol v4 & v6.

Unit II

Network infrastructure and Security-switches, routers, firewall, intranet, internet, Virtual Private Network. World Wide Web (www), working with Internet; Web pages, web sites, web servers; Web Applications.

Unit III

Hyper Text Markup Language (HTML), DHTML, web based application development.

UNIT IV

Static websites, dynamic websites. Client Side processing – scripting languages, Jquery. Server Side processing ASP.NET/JSP

Practical

- Network and mail configuration;
- Using Network Services;
- Browsing of Internet;
- Creation of web pages;
- Creation of websites using HTML and scripting languages.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

- Cox V, Wermers L and Reding E.E. 2006. *HTML Illustrated Complete*. 3rd Ed. Course Technology.
- Niederst J. 2001. *Web Design in a Nutshell*. O'Reilly Media.
- Tanenbaum A.S. 2003. Computer Networks. *Prentice* Hall of India.

MCA 512: Information Technology in Agriculture (2+0)

Aim of the course

This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand analogy of computer, basic knowledge of MS Office. Also to understand Internet and WWW, use of IT application and different IT tools in Agriculture

Theory

Unit I

Introduction to Computers, Anatomy of computer, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions,

Unit II

Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications,

Unit III

Use of ICT in Agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc.,

Unit IV

Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions, Preparation of contingent crop-planning using IT tools.

PEDAGOGY (Teaching methods/activities)

- Classroom lectures (oral + audio-visual)
- Assignment (Reading/Writing/solving problems)
- Class room exercises

Suggested Reading

• Vanitha G. 2011. *Agro-informatics*
• http://www.*agrimoon*.com
• http://www.agriinfo.in
• http://www.eagri.org
• http://www.agriglance.com
• http://agritech.tnau.ac.in

BCM 501: Basic Biochemistry (3+1)

Why this course?
To impart the fundamental knowledge on structure and function of cellular components involved in biological processes and an elementary introduction to the study of molecular biology.

Aim of the course
The course is designed to provide elementary knowledge/overview of structure and function of proteins, carbohydrates, lipids, nucleic acids and other biomolecules and their metabolism.

Theory
UNIT-I
Block 1: Introduction to Biochemistry-8
Section 1: Scope and importance of biochemistry (1 Lecture)
Biochemistry as modern science and its various divisions, Scope and importance of biochemistry in agriculture and allied sciences.
Section 2: Foundation of life (2 Lectures)
Fundamental principles governing life, supramolecular structures, significance of weak non covalent interactions in biology
Section 3: Water (3 Lectures)
Structure of water, ionization of water, acid base concept, pH and buffers, significance of structure-function relationship.
Section 4: Physical techniques for structure determination (2 Lectures)
General introduction to physical techniques for determination of structure of biopolymers.

UNIT-II
Block 2: Structure And Function of Biomolecules -15
Section 1: Biomolecules (10 Lectures)
Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids.
Section 2: Immunoglobulins and PR proteins (2 Lectures)
Structure, formation and different forms of immunoglobulins, PR proteins and their classification.
Section 3: Plant secondary metabolites (3 Lectures)
Structure, classification and function of plant secondary metabolites.

UNIT-III
Block 3: Metabolism – The Basics
Section 1: Molecules aiding metabolism (2 Lectures)
Structure and biological functions of vitamins and coenzymes, enzymes: classification and mechanism of action; regulation, factors affecting enzyme action. Hormones: animal and plants.
Section 2: Thermodynamics –principles and energetic of life (2 Lectures)
Fundamentals of thermodynamic principles applicable to biological processes, Bioenergetics.

Block 4: Catabolism and its Regulation

Section 1: Catabolism of energy molecules (5 Lectures)

Important and basic degradative metabolic pathways of carbohydrates, lipids and proteins and their regulation.

Section 2: ATP formation (3 Lectures)

Formation of ATP, substrate level phosphorylation, electron transport chain and oxidative phosphorylation, chemiosmotic theory and proton motive force.

UNIT-IV

Block 5: Fundamentals of Molecular Biology and Genetic Engineering

Section 1: Molecular biology processes (4 Lectures)

Overview of replication, transcription and translation.

Section 2: Recombinant DNA technology (3 Lectures)

Restriction enzymes, DNA cloning, applications of cloning, transgenics.

Practicals

- Preparation of standard and buffer solutions
- Detection of carbohydrates, amino acids and proteins
- Extraction and estimation of sugars
- Extraction and estimation of amino acids
- Extraction and estimation of proteins
- Estimation of acid value of fat/oil
- Estimation of peroxide value of fat/oil
- Estimation of saponification value in fats and oils
- Fatty acid composition in fat/oil by GC
- Estimation of DNA and RNA by spectroscopic methods
- Estimation of Ascorbic acid
- Separation of biomolecules by TLC and Paper chromatography
- Estimation of alpha amylase activity
- Qualitative tests for secondary plant metabolites.

Teaching methods/activities

– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz

Learning outcome

With this course, the students are expected to be able to understand the actual chemical concepts and fundamental processes of biology at molecular level.

Suggested Reading

- Nelson DL and Cox MM. 2017. *Lehninger Principles of Biochemistry*. 7th edition. W. H. Freeman & Co Ltd
- Satyanarayana U and Chakrapani U. 2017. *Biochemistry*. 5th edition, Elsevier
- Moran LA, Horton HR, Scrimgeour KG and Perry MD. 2012. *Principles of Biochemistry*. 5th edition Pearson.
- Voet D and Voet JG. 2011. *Biochemistry*. 4th edition John Wiley.
- Pratt CW and Cornely K. 2014. *Essential Biochemistry*. 3rd Edition. Wiley
- Moorthy K. 2007. *Fundamentals of Biochemical Calculations*. 2nd edition. CRC Press
- Conn EE, Stumpf PK, Bruening G and Doi RH. 2006. *Outlines of Biochemistry*. 5th edition. Wiley.

BCM 505: Techniques in Biochemistry (2+2)

Why this course?

Biochemical studies rely on the availability of appropriate analytical techniques and their applications. This course will examine modern methods and technologies that are used in biochemical analysis with emphasis on instrumentation, underlying principles, aims, strategies and current applications.

Aim of the course

To provide hands-on experience to different biochemical techniques commonly used in research along with the knowledge on principles and the instrumentation**.**

Theory

Unit I

Block 1: Separation Techniques

Principles and applications of separation techniques.

Section 1: Chromatography techniques (4 Lectures)

Principles and applications of paper, thin layer, gel filtration, ion-exchange, affinity, column & HPTLC, GC, HPLC and FPLC.

Section 2: Electrophoretic technique (2 Lectures)

General principles, paper and gel electrophoresis, native and SDS-PAGE, 2D-PAGE, capillary electrophoresis.

Section 3: Hydrodynamic methods (2 Lectures)

Hydrodyanmic methods of separation of biomolecules such as viscosity and sedimentation velocity, - their principles.

Section 4: Centrifugation (2 Lectures)

Basic principles of sedimentation, type, care and safety aspects of centrifuge preparative and analytical centrifugation.

Unit II

Block 2: Spectroscopic Techniques

Section 1: Spectrophotometry (3 Lectures)

Principles and applications of UV-visible, Fluorescence, IR and FTIR, Raman, NMR and FTNMR, ESR and X-Ray spectroscopy.

Section 2: Mass spectroscopy (3 Lectures)

MS/MS, LC-MS, GC-MS, MALDI-TOF, applications of mass spectrometry in biochemistry.

Section 3: Atomic absorption spectrophotometry (2 Lectures)

Principle, function and instrumentation of atomic absorption spectrophotometry.

Unit III

Block 3. Microscopy

Section 1: Microscopic techniques (2 Lectures)

Principles and applications, light, UV, phase contrast, fluorescence and electron microscopy, flow cytometry.

Unit IV

Block 4: Tracer, Imaging, Immunochemical and Other Techniques

Section 1: Tracer technique (2 Lectures)

Tracer techniques in biology: concept of radioactivity, radioactivity counting methods with principles of different types of counters, concept of á, â and ã emitters, scintillation counters, Gamma-ray spectrometers, autoradiography, applications of radioactive tracers in biology.

Section 2: Imaging techniques (2 Lectures)

Principles and applications of phosphor imager, MRI and CT scan.

Section 3: Immunochemical technique (2 Lectures)

Production of antibodies, immunoprecipitation, immunoblotting, immunoassays, RIA and ELISA.

Section 4: Other techniques (2 Lectures)

Cryopreservation, polymerase chain reaction (PCR), FACS.

Practicals

- Expression of concentration in terms of dilution, molarity, normality, percent expression
- pH measurement and buffer preparation
- Determination of absorption maxima of biomolecules
- Estimation of biomolecules through spectrophotometry and other methods
- Separation of carbohydrates and amino acids by paper chromatography
- Separation and analysis of fatty acids/lipids by GC
- Separation/estimation of biomolecules through HPLC and FPLC
- Separation of proteins using ion exchange, gel filtration and affinity chromatography
- Electrophoretic separation of proteins and nucleic acids
- Centrifugation- differential and density gradient
- (NH4)2SO4 precipitation and dialysis
- Use of radioisotopes in metabolic studies
- PCR
- ELISA
- Western blotting/ Dot blotting

Teaching methods/activities

– Classroom lectures (oral + audio-visual)
– Assignment (Reading/Writing)
– Oral presentation by students on specified topics
– Class room quiz
– Case study

Learning outcome

At the end of the course, the student will acquire the basic knowledge of the main biochemical methods used in the separation, identification, characterization and analysis of biomolecules.

Suggested Reading

• Boyer R. 2011. *Biochemistry Laboratory: Modern Theory and Techniques* 2nd Edition. Pearson
• Hofmann A and Clokie S. 2010. *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*. 7th edition. Cambridge University Press.
• Sawhney SK and Singh R. 2000. *Introductory Practical Biochemistry*. 2nd Ed. Narosa
• Katoch R. 2011. *Analytical Techniques in Biochemistry and Molecular Biology*. Springer
• Boyer R. 2009. *Modern Experimental Biochemistry*. Fifth impression. Pearson
• Lottspeich F and Engels JW. (Eds). 2018. *Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology.* Wiley-VCH
• Wilson K and Walker J. 2010. *Principles and Techniques of Biochemistry and Molecular Biology*, 7th Edition. Cambridge University Press

COURSES FOR M. Sc. (AGRI.) IN GENETICS & PLANT BREEDING

Code	Course Title	Credits	Credit Pattern	Credit Value
GPB 501*#	Principles of Genetics	3	2+1	3
GPB 502*#	Principles of Plant Breeding	3	2+1	3
GPB 503*#	Fundamentals of Quantitative Genetics	3	2+1	3
GPB 504	Varietal Development and Maintenance Breeding	2	1+1	2
GPB 505 #	Principles of Cytogenetics	3	2+1	3
GPB 506*#	Molecular Breeding and Bioinformatics	3	2+1	3
GPB 507	Breeding for Quality and Special Traits	3	2+1	3
GPB 508#	Mutagenesis and Mutation Breeding	3	2+1	3
GPB 509#	Hybrid Breeding	3	2+1	3
GPB 510	Seed Production and Certification	2	1+1	2
GPB 511	Crop Breeding-I (Kharif Crops)	3	2+1	3
GPB 512	Crop Breeding-II (Rabi Crops)	3	2+1	3
GPB 513	Breeding Vegetable Crops	3	2+1	3
GPB 514	Breeding Fruit Crops	3	2+1	3
GPB 515	Breeding Ornamental Crops	3	2+1	3
GPB 516	Breeding for Stress Resistance and Climate Change	3	2+1	3
GPB 517	Germplasm Characterization and Evaluation	2	1+1	2
GPB 518	Genetic enhancement for PGR Utilization	2	1+1	2
GPB 519	Population Genetics	2	2+0	2
GPB 581	Qualifying Examination	2	0+2	2
GPB 591	Master's seminar I	1	0+1	1
GPB 592	Master's seminar II	1	0+1	1
GPB 599	Master's research	27	0+27	27

- * Compulsory core courses as listed according to ICAR-BSMA
- # Compulsory core courses as listed according to SIIASHT
- All other courses are eligible to be taken as Minor courses all the disciplines
- GPB 519 listed as minor course for all GPB students. Note : the course was added by SIIASHT

SYLLABUS FOR GENETICS & PLANT BREEDING COURSES FOR M. Sc. (AGRI.) IN GENETICS & PLANT BREEDING

GPB 501: Principles of Genetics 3 (2+1)

Why this course?

Genes are the backbone of all crop improvement activities. Their chemical structure and physical inheritance are pivotal for any breeding program. Therefore, it has to be the core course for master's degree in Genetics and Plant Breeding.

Aim of the course

This course is aimed at understanding the basic concepts of inheritance of genetic traits, helping students to develop their analytical, quantitative and problem-solving skills from classical to molecular genetics.

Theory

Unit I

Beginning of genetics**,** early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance. Mendelian population, Random mating population, Frequencies of genes and genotypes, Causes of change: Hardy-Weinberg equilibrium.

Unit II

Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis, Genetic fine structure analysis, Allelic complementation, Split genes, overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes and eukaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression, RNA editing.

Unit III

Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs).

Unit IV

Genomics and proteomics; metagenomics; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts. Concepts of Eugenics, Epigenetics, Genetic disorders.

Practical

• Laboratory exercises in probability and chi-square;
• Demonstration of genetic principles using laboratory organisms;
• Chromosome mapping using three-point test cross;
• Tetrad analysis; Induction and detection of mutations through genetic tests;
• DNA extraction and PCR amplification;
• Electrophoresis: basic principles and running of amplified DNA;
• Extraction of proteins and isozymes;
• Use of *Agrobacterium* mediated method and Biolistic gun;
• Detection of transgenes in the exposed plant material;
• Visit to transgenic glasshouse and learning the practical considerations.

PEDAGOGY (Teaching methods/activities)

• Power point presentation
• Chalk and Board
• Smart board
• Lectures
• Assignments, quiz
• Group tasks, student's presentations

Learning outcome

After passing out this course the student will be able to know the difference between the genotype and phenotype, can carry study on inheritance and also know the role of DNA and RNA in genotypic manifestation of characters.

Suggested reading

Daniel LH and Maryellen R. 2011. *Genetics:* "*Analysis of Genes and Genomes*".

Gardner EJ and Snustad DP. 1991. *Principles of Genetics*. John Wiley and Sons. 8th ed. 2006

Klug WS and Cummings MR. 2003. *Concepts of Genetics*. Peterson Edu. Pearson Education India; Tenth edition

Lewin B. 2008. *Genes XII*. Jones and Bartlett Publ. (International Edition) Paperback, 2018

Russell PJ. 1998. *Genetics*. The Benzamin/ Cummings Publ. Co

Singh BD. 2009. *Genetics.* Kalyani Publishers (2nd Revised Edition)

Snustad DP and Simmons MJ. 2006. *Genetics*. 4th Ed. John Wiley and Sons. 6th Edition International Student Version edition

Stansfield WD.1991. *Genetics.* Schaum Outline Series Mc Graw Hill

Strickberger MW. 2005. *Genetics* (*III Ed*). Prentice Hall, New Delhi, India; 3rd ed., 2015

Tamarin RH. 1999. *Principles of Genetics*. Wm. C. Brown Publs., McGraw Hill Education; 7 edition

Uppal S, Yadav R, Singh S and Saharan RP. 2005. *Practical Manual on Basic and Applied Genetics*. Dept. of Genetics, CCS HAU Hisar.

GPB 502: Principles of Plant Breeding 3(2+1)

Why this course?
Development of plant variety is the ultimate aim of any plant breeding program. A post graduate in the subject of agriculture must know what are the different selection methods, techniques and related crop improvement strategies. Further, knowledge of genetic resources, evolution and their role in development of noble varieties is the need of the hour.

Aim of the course
To impart theoretical knowledge and practical skills about plant breeding objectives, genetic consequences, breeding methods for crop improvement.

Theory
Unit I
Early Plant Breeding; Accomplishments through plant breeding; Objectives of plant breeding; Patterns of Evolution in Crop Plants: Centre of Origin, Agro-biodiversity and its significance. Pre-breeding and plant introduction and role of plant genetic resources in plant breeding. Genetic basis of breeding: self and cross pollinated crops including mating systems and response to selection

Unit II
Nature of variability, components of variation; Heritability and genetic advance, genotype environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding. Pure line theory, pure line and mass selection methods; pedigree, bulk, backcross, single seed descent and multiline breeding; Population breeding in self-pollinated crops with special reference to diallel selective mating; Transgressive breeding.

Unit III
Breeding methods in cross pollinated crops; Population breeding: mass selection and ear-to-row methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and inter-population improvement and development of synthetics and composites. Hybrid breeding: genetical and physiological basis of heterosis and inbreeding, production of inbreeds, breeding approaches for improvement of inbreeds, predicting hybrid performance; seed production of hybrid and their parent varieties/ inbreeds. Self-incompatibility, male sterility and apomixes in crop plants and their commercial exploitation.

Unit IV
Breeding methods in asexually/ clonally propagated crops, clonal selection. Special breeding techniques: Mutation breeding, Breeding for abiotic and biotic stresses; Concept of plant ideotype and its role in crop improvement, concept of MAS, concept of polyploidy and wide hybridization, doubled haploidy. Cultivar development: testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.

Practical

• Floral biology in self and cross pollinated species;
• Selfing and crossing techniques;
• Selection methods in segregating populations and evaluation of breeding material;
• Analysis of variance (ANOVA);
• Estimation of heritability and genetic advance;
• Maintenance of experimental records;
• Learning techniques in hybrid seed production using male-sterility in field crops;
• Prediction of performance of double cross hybrid.

PEDAGOGY (Teaching methods/activities)

• Power point presentation
• Chalk and Board
• Smart board
• Lectures
• Assignments, quiz
• Group tasks, student's presentations

Learning outcome

The knowledge of this course will enable the student to know breeding methods, different hybridization techniques for genomic reshuffling. The course will also acquaint the student with importance of floral biology, mutation breeding and participatory plant breeding, etc.

Suggested Reading

Allard RW. 1981. *Principles of Plant Breeding*. John Wiley & Sons.
Chahal GS and Gosal, SS. 2002. *Principles and Procedures of Plant Breeding Biotechnological and Conventional approaches.* Narosa Publishing House.
Chopra VL. 2004. *Plant Breeding*. Oxford & IBH.
George A. 2012. *Principles of Plant Genetics and Breeding*. John Wiley & Sons.
Gupta SK. 2005. *Practical Plant Breeding*. Agribios.
Jain HK and Kharakwal MC. 2004. *Plant Breeding and–Mendelian to Molecular Approach*, Narosa Publications, New Delhi
Roy D. 2003. *Plant Breeding, Analysis and Exploitation of Variation*. Narosa Publ. House.
Sharma JR. 2001. *Principles and Practice of Plant Breeding*. Tata McGraw-Hill.
Sharma JP. 2010. Principles of Vegetable Breeding. Kalyani Publ, New Delhi.
Simmonds NW.1990. *Principles of Crop Improvement*. English Language Book Society.
Singh BD. 2006. *Plant Breeding*. Kalyani Publishers, New Delhi.
Singh S and Pawar IS. 2006. *Genetic Bases and Methods of Plant Breeding*. CBS.

GPB 503: Fundamentals of Quantitative Genetics 3 (2+1)

Why this course?
Yield and quality characters are controlled by many genes and show the quantitative inheritance. If one has to go for improvement even for the components characters the knowledge of this course is very essential.

Aim of the course
To impart theoretical knowledge and computation skills regarding components of variation and variances, scales, mating designs and gene effects.

Theory
Unit I
Introduction and historical background of quantitative genetics, Multiple factor hypothesis, Qualitative and quantitative characters, Analysis of continuous variation mean, range, SD, CV; Components of variation- Phenotypic, Genotypic, Nature of gene action- additive, dominance and epistatic, linkage effect. Principles of analysis of variance and linear model, Expected variance components, Random and fixed effect model, Comparison of means and variances for significance.

Unit II
Designs for plant breeding experiments- principles and applications; Variability parameters, concept of selection, simultaneous selection modes and selection of parents, MANOVA. Association analysis- Genotypic and phenotypic correlation, Path analysis Discriminate function and principal component analysis, Genetic divergence analysis- Metroglyph and D2, Generation mean analysis, Parent progeny regression analysis

Unit III
Mating designs- classification, Diallel, partial diallel, L × T, NCDs, and TTC; Concept of combining ability and gene action, G × E interaction-Adaptability and stability; Methods and models for stability analysis; Basic models- principles and interpretation, Bi-plot analysis.

Unit IV
QTL mapping, Strategies for QTL mapping- Desired population and statistical methods, QTL mapping in genetic analysis; Markers, Marker assisted selection and factors influencing the MAS, Simultaneous selection based on marker and phenotype.

Practical
- Analysis and interpretation of variability parameters;
- Analysis and interpretation of Index score and Metroglyph;
- Clustering and interpretation of D2 analysis;
- Genotypic and phenotypic correlation analysis and interpretation;
- Path coefficient analysis and interpretation, Estimation of different types of heterosis, inbreeding depression and interpretation;
- A, B and C Scaling test;

• L × T analysis and interpretation, QTL analysis;
• Use of computer packages;
• Diallel analysis;
• G × E interaction and stability analysis.

PEDAGOGY (Teaching methods/activities)
• Power point presentation
• Chalk and Board
• Smart board
• Lectures,
• Assignments, quiz
• Group tasks, student's presentations

Learning outcome
After studying this course, the student will be equipped with the knowledge of additive dominance and epistatic gene action. He will also be introduced with the various designs for analysis of genotypic and phenotypic variance and QTL mapping.

Suggested Reading
Bos I and Caligari P. 1995. *Selection Methods in Plant Breeding*. Chapman & Hall.
Falconer DS and Mackay J. 1998. *Introduction to Quantitative Genetics* (3rd Ed.).ELBS/ Longman, London.
Mather K and Jinks JL.1985. *Biometrical Genetics* (3rd Ed.). Chapman and Hall, London.
Nandarajan N and Gunasekaran M. 2008. *Quantitative Genetics and Biometrical Techniques in Plant Breeding*. Kalyani Publishers, New Delhi.
Narayanan SS and Singh P. 2007. *Biometrical Techniques in Plant Breeding*. Kalyani Publishers, New Delhi.
Roy D. 2000. *Plant Breeding: Analysis and Exploitation of Variation*. Narosa Publishing House, New Delhi.
Sharma JR. 2006. *Statistical and Biometrical Techniques in Plant Breeding*. New Age International Pvt. Ltd.
Singh P and Narayanan SS. 1993. *Biometrical Techniques in Plant Breeding.* Kalyani Publishers, New Delhi.
Singh RK and Chaudhary BD. 1987. *Biometrical Methods in Quantitative Genetic* analysis. Kalyani Publishers, New Delhi.
Weir DS. 1990. *Genetic Data Analysis. Methods for Discrete Population Genetic Data*. Sinauer Associates.
Wricke G and Weber WE. 1986. *Quantitative Genetics and Selection in Plant Breeding*. Walter de Gruyter.

e-Suggested Reading
www.iasri.icar.gov.in
www.hau.ac.in/OPstat

504: Varietal Development and Maintenance Breeding 2(1+1)

Why this course?

It is an indispensable course which apprise the students about various practices and procedures in the development of a variety and steps to maintain the purity of varieties/ hybrids. Further, it provides basics of nucleus and breeder seed production techniques.

Aim of the course

The purpose of this course is to make students well acquainted with the techniques and procedures of varietal development. He will be associated with development of variety so the course aims is to provide knowledge on DUS testing, protocols of various breeding techniques, procedures of release of variety, maintenance of the variety and production of nucleus and breeder seed of variety/ hybrids.

Theory

Unit I

Variety Development systemsand Maintenance; Definition- variety, cultivar, extant variety, essentially derived variety, independently derived variety, reference variety, farmers' variety, landraces, hybrid, and population; Variety testing, release and notification systems and norms in India and abroad.

Unit II

DUS testing- DUS Descriptors for major crops; Genetic purity concept and maintenance breeding. Factors responsible for genetic deterioration of varieties - safeguards during seed production. Maintenance of varieties in self and cross pollinated crops, isolation distance; Principles of seed production; Methods of nucleus and breeder seed production; Generation system of seed multiplication -nucleus, breeders, foundation, certified.

Unit III

Quality seed production technology of self and cross-pollinated crop varieties, viz., cereals and millets (wheat, barley, paddy, pearlmillet, sorghum, maize and ragi, etc.); Pulses (greengram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean, sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibres (cotton/ jute) and forages (guar, forage sorghum, teosinte, oats, berseem, lucerne).

Unit IV

Seed certification procedures; Seed laws and acts, plant variety protection regulations in India and international systems.

Practical

- Identification of suitable areas/ locations for seed production;
- Ear-to-row method and nucleus seed production;
- Main characteristics of released and notified varieties, hybrids and parental lines;
- PGMS and TGMS;
- Identification of important weeds/ objectionable weeds;
- Determination of isolation distance and planting ratios in different crops; Seed production techniques of varieties in different crops;
- Hybrid seed production technology of important crops;
- DUS testing and descriptors in major crops;
- Variety release proposal formats in different crops.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

Pass out student will have complete knowledge on the various procedures linked with the development and release of variety. This course will also enable student how to maintain and multiply variety for large scale distribution. It will also make student acquainted with the seed laws and acts related to plant variety protection.

Suggested Reading

Agarwal RL. 1997. *Seed Technology*. 2nd Ed. Oxford & IBH.
Kelly AF. 1988. *Seed Production of Agricultural Crops*. Longman.
McDonald MB Jr and Copeland LO. 1997. *Seed Production: Principles and Practices*. Chapman & Hall.
Poehlman JM and Borthakur D. 1969. *Breeding Asian Field Crops*. Oxford & IBH.
Singh BD. 2005. *Plant Breeding: Principles and Methods*. Kalyani. 2015
Thompson JR. 1979. *An Introduction to Seed Technology*. Leonard Hill

GPB 505: Principles of Cytogenetics 3 (2+1)

Why this course?

The very purpose of this course is to acquaint the students with cell cycle and architecture of chromosome in prokaryotes and eukaryotes, special types of chromosomes, techniques for karyotyping. This course aims to impart knowledge of variations in chromosomes numbers and their structures. It acquaints the students for the production and use of haploids, apomictic populations and their role in genetics and breeding.

Aim of the course

To provide insight into structure and functions of chromosomes, chromosome mapping, polyploidy and cytogenetic aspects of crop evolution.

Theory

Unit I

Cell cycle and architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; artificial chromosome construction and its uses; Special types of chromosomes. Variation in chromosome structure: Evolutionary significance; Introduction to techniques for karyotyping; Chromosome banding and painting -*In situ* hybridization and various applications.

Unit II

Structural and numerical variations of chromosomes and their implications; Symbols and terminologies for chromosome numbers, euploidy, haploids, diploids and polyploids; Utilization of aneuploids in gene location; Variation in chromosome behaviour, somatic segregation and chimeras, endomitosis and somatic reduction; Evolutionary significance of chromosomal aberrations, balanced lethal and chromosome complexes; Inter-varietal chromosome substitutions. Fertilization barriers in crop plants at pre-and postfertilization levels; *In-vitro* techniques to overcome the fertilization barriers in crops; Polyploidy. Genetic consequences of polyploidization and role of polyploids in crop breeding;

Unit III

Evolutionary advantages of autopolyploid *vs* allopolyploids; Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer; Alien addition and substitution lines, creation and utilization; Apomixis, evolutionary and genetic problems in crops with apomixes. Reversion of autopolyploid to diploids; Genome mapping in polyploids; Interspecific hybridization and allopolyploids;

Unit IV

Synthesis of new crops (wheat, *Triticale, Brassica***,** and cotton); Hybrids between species with same chromosome number, alien translocations; Hybrids between species with different chromosome number; Gene transfer using amphidiploids, bridge species. Chromosome manipulations in wide hybridization; case studies; Production and use of haploids, dihaploids and doubled haploids in genetics and breeding.

Practical

- Learning the cytogenetical laboratory techniques, various chemicals to be used for fixation, dehydration, embedding, staining, cleaning, etc.;
- Microscopy: various types of microscopes;
- Preparing specimen for observation;
- Fixative preparation and fixing specimen for light microscopy studies in cereals;
- Studies on mitosis and meiosis in crop plants;
- Using micrometres and studying the pollen grain size in various crops. Pollen germination *in vivo* and *in-vitro*;
- Demonstration of polyploidy.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

The course will provide full knowledge to the student on the various procedures linked with cell development and chromosome structure and function. This course will also enable student how to tailor and utilize the variation in chromosome number and structures in the development and synthesis of new species and varieties.

Suggested Reading

Becker K and Hardin J. 2004. *World of the Cell*. 5th Ed. Pearson Edu. 9th edition.

Carroll M. 1989. *Organelles*. The Guilford Press.

Charles B. 1993. *Discussions in Cytogenetics*. Prentice Hall Publications.

Darlington CD and La Cour LF. 1969. *The Handling of Chromosomes*. George Allen & Unwin Ltd.

Elgin SCR. 1995. *Chromatin Structure and Gene Expression*. IRL Press,Oxford.

Gupta PK and Tsuchiya T. 1991. *Chromosome Engineering in Plants: Genetics, Breeding and Evolution*. Part A.

Gupta PK. 2010. *Cytogenetics*. Rastogi Pubishers.

Johannson DA. 1975. *Plant Micro technique*. McGraw Hill.

Karp G. 1996. *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.

Khush GS. 1973. *Cytogenetics of aneuploids*. Elsevier. 1 edition.

Roy D.2009. *Cytogenetics*. Alpha Science Intl Ltd.

Schulz SJ.1980. *Cytogenetics- Plant, animals and Humans*. Springer.

Sharma AK and Sharma A. 1988. *Chromosome Techniques: Theory and Practice*. Butterworth-Heinemann publisher 2014.3rd edition

Singh RJ. 2016. Plant *Cytogenetics* 3rd Edition. CRC Press.

Sumner AT. 1982. *Chromosome Banding*. Unwin Hyman Publ. 1 edition, Springer pub.

Swanson CP. 1960. *Cytology and Cytogenetics*. Macmillan & Co.

GPB 506: Molecular Breeding and Bioinformatics 3(2+1)

Why this course?
The course will provide deep knowledge to the students on genotyping and kinds of markers including biochemical and molecular, mapping populations, allele mining. This will also add ways to perform marker-assisted selection and gene pyramiding to evolve superior varieties.

Aim of the course
To impart knowledge and practical skills to use innovative approaches and Bioinformatics in Plant Breeding.

Theory
Unit I
Genotyping; Biochemical and Molecular markers; Morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR, SNPs, ESTs, etc.), Functional markers; Mapping populations (F2s, back crosses, RILs, NILs and DH); Molecular mapping and tagging of agronomically important traits; Statistical tools in marker analysis.

Unit II
Allele mining; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants; Marker-assisted backcross breeding for rapid introgression; Genomics- assisted breeding; Generation of EDVs; Gene pyramiding.

Unit III
Introduction to Comparative Genomics; Large scale genome sequencing strategies; Human genome project; Arabidopsis genome project; Rice genome project; Comparative genomics tools; Introduction to proteomics; 2D gel electrophoresis; chromatography and sequencing by Edman degradation and mass spectrometry; Endopeptidases; Nanotechnology and its applications in crop improvement.

Unit IV
Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer; Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane, etc. and commercial releases; Biotechnology applications in male sterility/ hybrid breeding, molecular farming; Application of Tissue culture in molecular breeding; MOs and related issues (risk and regulations); GMO; International regulations, biosafety issues of GMOs; Regulatory procedures in major countries including India, ethical, legal and social issues; Intellectual property rights; Introduction to bioinformatics: bioinformatics tools, biological data bases (primary and secondary), implications in crop improvement.

Practical

- Requirements for plant tissue culture laboratory;
- Techniques in plant tissue culture;
- Media components and media preparation;
- Aseptic manipulation of various explants, observations on the contaminants occurring in media, interpretations;
- Inoculation of explants, callus induction and plant regeneration; Standardizing the protocols for regeneration;
- Hardening of regenerated plants; Establishing a greenhouse and hardening procedures;
- Visit to commercial micropropagation unit;
- Transformation using Agrobacterium strains;
- GUS assay in transformed cells/ tissues;
- DNA isolation, DNA purity and quantification tests;
- Gel electrophoresis of proteins and isozymes, PCR-based DNA markers, gel scoring and data analysis for tagging and phylogenetic relationship;
- Construction of genetic linkage maps using computer software;
- NCBI Genomic Resources, GBFF, Swiss Prot, Blast n/ Blast p, Gene Prediction Tool, Expasy Resources, PUBMED and PMC, OMIM and OMIA, ORF finder;
- Comparative Genomic Resources: - Map Viewer (UCSC Browser and Ensemble);
- Primer designing- Primer 3/ Primer BLAST.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning Outcome

The knowledge of this course will enable the student to know about various molecular tools and approaches for genotyping and marker assisted breeding, intellectual property rights, bioinformatics tools and their uses in crop improvement.

Suggested Reading

Azuaje F and Dopazo J. 2005. *Data Analysis and Visualization in Genomics and Proteomics.* John Wiley and Sons.

Brown TA. 1991. *Essential Molecular Biology: a practical Approach*. Oxford university press, 2002, 2nd edition

Chawla HS. 2000. *Introduction to Plant Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd.

Chopra VL and Nasim A. 1990. *Genetic Engineering and Biotechnology: Concepts, Methods and Applications*. Oxford & IBH.

Gupta PK. 1997. *Elements of Biotechnology*. Rastogi Publ.

Hackett PB, Fuchs JA and Messing JW. 1988. *An Introduction to Recombinant DNA Technology - Basic Experiments in Gene Manipulation*. 2nd Ed. Benjamin Publ. Co.

Jollès P and Jörnvall H. 2000. *Proteomics in Functional Genomics: Protein Structure Analysis*. Birkhäuser.

Lewin B. 2017. *Genes XII*. Jones & Bartlett learning, 2017.

Robert NT and Dennis JG. 2010. *Plant Tissue Culture, Development, and Biotechnology*. CRC Press.

Sambrook J and Russel D. 2001. *Molecular Cloning - a Laboratory Manual*. 3rd Ed. Cold Spring Harbor Lab. Press.

Singh BD. 2005. *Biotechnology, Expanding Horizons*. Kalyani Publishers, New Delhi.

Watson J. 2006. *Recombinant DNA*. Cold Spring harbor laboratory press.

GPB 507: Breeding for Quality and Special Traits 3(2+1)

Why this course?

Quality consciousness is growing in the society and only quality products are in demand in the market so has to be the new varieties. This course acquaints breeding for grain quality parameters in field crops. It will also teach about the genetic engineering protocols for quality improvement: Biofortification in crops and Nutritional genomics and Second generation transgenics.

Aim of the course

To provide insight into recent advances in improvement of quality traits in cereals, millets, legumes, oilseeds, forage and industrial crops using conventional and modern biotechnological approaches.

Theory

Unit I

Developmental biochemistry and genetics of carbohydrates, proteins, fats, vitamins, amino acids and anti-nutritional factors; Nutritional improvement - A human perspective.

Unit II

Breeding for grain quality parameters in rice and its analysis; Golden rice and aromatic rice: Breeding strategies, achievements and application in Indian context; Molecular basis of quality traits and their manipulation in rice; Post harvest manipulation for quality improvement; Breeding for baking qualities in wheat, characters to be considered and breeding strategies, molecular and cytogenetic manipulation for quality improvement in wheat. Breeding for quality improvement in Sorghum, pearl millet, barley and oats; Quality protein maize, specialty corns, concept and breeding strategies;

Unit III

Breeding for quality improvement in important forage crops for stay green traits; Genetic resource management for sustaining nutritive quality in crops. Breeding for quality improvement in pulses – Chickpea, pigeonpea, green gram and black gram cooking quality; Breeding for quality in oilseeds -groundnut**,** mustard, soybean, sesame, sunflower and minor oilseeds; Molecular basis of fat formation and manipulation to achieve more PUFA in oil crops;

Unit IV

Genetic manipulation for quality improvement in cotton. Breeding for quality improvement in Sugarcane, potato. Genetic engineering protocols for quality improvement: Achievements made; Biofortification in crops; Classification and importance, Nutritional genomics and Second generation transgenics.

Practical

- Grain quality evaluation in rice; Correlating ageing and quality improvement in rice;
- Quality analysis in millets;
- Estimation of anti-nutritional factors like tannins in different varieties/ hybrids: A comparison;
- Quality parameters evaluation in wheat, pulses and oilseeds;
- Evaluation of quality parameters in cotton, sugarcane and potato;
- Value addition in crop plants;
- Post-harvest processing of major field crops;
- Quality improvement in crops through tissue culture techniques;
- Evaluating the available populations like RIL, NIL, etc. for quality improvement using MAS procedures;
- Successful example of application of MAS for quality trait in rice, mustard, maize, etc.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

The knowledge of this course will expose the student to know about various conventional and genetic engineering techniques for the improvement of quality characters in agricultural and horticultural field crops.

Suggested Reading

Chahal GS and SS Ghosal. 2002. *Principles and procedures of plant breeding – Biotechnological and Conventional approaches***,** Narosa Publications

Chopra VL. 1997. *Plant Breeding*. Oxford & IBH. 2018.

FAO 2001. *Speciality Rices of the World - Breeding, Production and Marketing*. Oxford & IBH,1 Nov 2001.

Ghosh P. 2004. *Fibre Science and Technology*. Tata McGraw Hill.

Gupta SK. 2007. *Advances in Botanical Research* Vol. 45 Academic Press USA.

Hay RK. 2006. *Physiology of Crop Yield*. 2nd Ed. Blackwell.

Nigam J. 1996. *Genetic Improvement of Oilseed Crops*. Oxford & IBH.

Singh BD. 1997. *Plant Breeding*. Kalyani Publishers, New Delhi.

Singh RK, Singh UK and Khush GS. 2000. *Aromatic Rices*. Oxford & IBH.

GPB 508: Mutagenesis and Mutation Breeding 3 (2+1)

Why this course?

The knowledge of this course will enable the students to learn about mutation, various methods of inducing mutations and their utilization in plant breeding. It will also give in depth knowledge about genomics, allele mining, TILLING, etc. and their utilization in crop improvement programmes.

Aim of the course

To impart the knowledge about general principles of mutagenesis for crop improvement and various tests/ methods for detection of mutations.

Theory

Unit I

Mutation and its history, nature and classification of mutations: spontaneous and induced mutations, micro and macro mutations, pre and post adaptive mutations; Detection of mutations. Paramutations in crops plants.

Unit II

Mutagenic agents: physical – radiation types and sources: Ionizing and non-ionizing radiations. Radiobiology: mechanism of action of various radiations (photoelectric absorption, Compton scattering and pair production) and their biological effects – RBE and LET relationships; Effect of mutations on DNA – repair mechanisms operating at DNA, chromosome, cell and organism level to counteract the mutation effects; Dosimetry -Objects and methods of treatment; Factors influencing mutation: dose rate, acute vs chronic irradiation, recurrent irradiation, enhancement of thermal neutron effects; Radiation sensitivity and modifying factors: External and internal sources – Oxygen, water content, temperature and nuclear volume.

Unit III

Chemical mutagens: Classification – base analogues, antibiotics, alkylating agents, acridine dyes and other mutagens: their properties and mode of action; Dose determination and factors influencing chemical mutagenesis; Treatment methods using physical and chemical mutagens, Combination treatments; other causes of mutation – direct and indirect action, comparative evaluation of physical and chemical mutagens. Observing mutagen effects in M1 generation: plant injury, lethality, sterility, chimeras, etc.; Observing mutagen effects in M2 generation;

Unit IV

Estimation of mutagenic efficiency and effectiveness – spectrum of chlorophyll and viable mutations; Mutations in traits with continuous variation; Factors influencing the mutant spectrum: genotype, type of mutagen and dose, pleiotropy and linkage, etc.; Individual plant based mutation analysis and working out effectiveness and efficiency in M3 generation; Comparative evaluation of physical and chemical mutagens for creation of variability in the some species- Case studies. Use of mutagens in creating oligogenic and polygenic variations – Case studies; *In-vitro* mutagenesis – Callus and pollen irradiation; Handling of segregating M2 generations and selection procedures; Validation of mutants; Mutation breeding for various traits
(disease resistance, insect resistance, quality improvement, etc.) in different crops; Procedures for micromutations breeding/ polygenic mutations; Achievements of mutation breeding- varieties released across the world, problems associated with mutation breeding. Use of mutagens in genomics, allele mining, TILLING.

Practical

- Precautions on handling of mutagens; Dosimetry-Studies of different mutagenic agents:Physical mutagens and Chemical mutagens;
- Learning on Radioactivity- Production source and isotopes at BRIT, Trombay, Learning about gamma chamber;
- Radiation hazards: Monitoring – safety regulations and safe transportation of radioisotopes, visit to radio isotope laboratory; learning on safe disposal of radioisotopes;
- Hazards due to chemical mutagens – Treating the plant propagules at different doses of physical and chemical mutagens;
- Procedures in combined mutagenic treatments;
- Raising the crop for observation; Mutagenic effectiveness and efficiency, calculating the same from earlier literature;
- Study of M1 generation – Parameters;
- Study of M2 generation – Parameters;
- Mutation breeding in cereals and pulses-achievements made and an analysis;
- Mutation breeding in oilseeds and cotton- achievements and opportunities;
- Mutation breeding in forage crops and vegetatively propagated crops;
- Procedure for detection of mutations for polygenic traits in M2 and M3 generations.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

This course will make the student well versed with the process of mutation and its use in crop improvement. This course will also give in depth knowledge of mutations in genomics, allele mining and TILLING.

Suggested Reading

Alper T. 1979. *Cellular Radiobiology*. Cambridge Univ. Press, London.

Chadwick KH and Leenhouts HP. 1981. *The Molecular Theory of Radiation Biology*. Springer-Verlag.

Cotton R, Edkin E and Forrest S. 2000. *Mutation Detection: A Practical Approach*. Oxford Univ. Press.

International Atomic Energy Agency. 1970. *Manual on Mutation Breeding*. International Atomic Energy Agency, Vienna, Italy.

Shu QY, Forster BP and Nakagawa N. 2012. *Plant Mutation Breeding and Biotechnology.* Gutecnberg Press Ltd. Rome Italy ISBN:978-925107-022-2 (FAO).

Singh BD. 2003. *Genetics*. Kalyani Publishers, New Delhi.

Strickberger MW. 2005. *Genetics*. 3rd Ed. Prentice Hall.

www.barc.gov.in

GPB 509: Hybrid Breeding 3(2+1)

Why this course?
This course will expose the students with the basic concepts of hybrid varieties and various techniques for development of hybrids in crop plants. This will also give an overview of various kinds of male sterility and their utilization in hybrid seed production of important field crops.

Aim of the course
To provide knowledge of understanding about mechanisms of heterosis and its exploitation for yield improvement through conventional and biotechnological approaches.

Theory
Unit I
Historical aspect of heterosis, nomenclature and definitions of heterosis; Heterosis in natural population and inbred population; Evolutionary aspects – Genetic consequences of selfing, sibbing and crossing in self-and cross-pollinated and asexually propagated crops; Pre-Mendelian and Post-Mendelian ideas – Evolutionary concepts of heterosis; Genetic theories of heterosis – Physiological, Biochemical and molecular factors underlining heterosis; theories and their estimation; Biometrical basis of heterosis.

Unit II
Prediction of heterosis from various crosses, inbreeding depression, coefficient of inbreeding and its estimation, residual heterosis in F2 and segregating populations, importance of inbreeding in exploitation of heterosis – case studies.; Relationship between genetic distance and expression of heterosis, case studies; Divergence and genetic distance analyses, morphological and molecular genetic distance in predicting heterosis; Development of heterotic pools in germplasm/ genetic stocks and inbreeds, their improvement for increasing heterosis. Male sterility and use in heterosis breeding; Male sterile line creation and diversification in self-pollinated, cross pollinated and asexually propagated crops;

Unit III
Creation of male sterility through genetic engineering and its exploitation in heterosis; Maintenance, transfer and restoration of different types of male sterility; Use of self-incompatibility in development of hybrids. Hybrid seed production system: 3-line, 2-line and 1-line system; Development of inbreeds and parental lines- A, B and R lines – functional male sterility; Commercial exploitation of heterosis, maintenance breeding of parental lines in hybrids;

Unit IV
Fixation of heterosis in self, cross and often cross pollinated crops, asexually/ clonally propagated crops, problems and prospects; Apomixis in fixing heterosis-concept of single line hybrid; Organellar heterosis and complementation. Hybrid breeding in wheat, rice, cotton, maize, pearl millet, sorghum and rapeseed mustard, sunflower, safflower and castor oilseed crops and pigeonpea.

Practical

- Characterization of male sterile lines using morphological descriptors;
- Restorer line identification and diversification of male sterile sources;
- Male sterile line creation in crop plants, problems in creation of CGMS system, ways of overcoming them;
- Diversification and restoration;
- Success stories of hybrid breeding in Maize, Rice, Pearl millet, Sorghum and Pigeon pea;
- Understanding the difficulties in breeding apomicts;
- Estimation of heterotic parameters in self, cross and asexually propagated crops;
- Estimation from the various models for heterosis parameters;
- Hybrid seed production in field crops—an account on the released hybrids, their potential, problems and ways of overcoming it;
- Hybrid breeding at National and International level, opportunities ahead.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completing this course, the student will be able to know about importance of heterosis, the various conventional and biotechnological approaches for the development of hybrids. This will also enable student to know about the use of male sterility in hybrid seed production of important field crops.

Suggested Reading

Agarwal RL. 1998. *Fundamental of Plant Breeding and hybrid Seed Production*. Science Publisher London.

Akin E. 1979. *The Geometry of Population Genetics*. Springer-Verlag.

Ben HL. 1998. *Statistical Genomics – Linkage, Mapping and QTL Analysis*. CRC Press.

Chahal GS and Gossal SS. 2002. *Principles and procedures of Plant Breeding, Biotechnology and Conventional Approaches*. Narosa Publishing House. New Delhi

De JG. 1988. *Population Genetics and Evolution*. Springer-Verlag. 30 January 2012

Hartl DL. 2000. *A Primer of Population Genetics*. 3rd Ed. Sinauer Assoc.

Mettler LE and Gregg TG. 1969. *Population Genetics and Evolution*. Prentice-Hall. 25 April 1988

Montgomery DC. 2001. *Design and Analysis of Experiments*. 5th Ed., Wiley & Sons. 2013

Mukherjee BK. 1995.*The Heterosis Phenomenon*. Kalyani Publishers, New Delhi.

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Richards AJ. 1986. *Plant Breeding Systems*. George Allen & Unwin. 30 May 1997

Singh BD. 2006. *Plant Breeding*. Kalyani Publishers, New Delhi.

Srivastava S and Tyagi R. 1997. *Selected Problems in Genetics*. Vols. I, II. Anmol Publ.

Virmani SS. 1994. *Heterosis and Hybrid Rice Breeding. Monographs of "Theoretical and Applied Genetics*", Springer-Verlag.

GPB 510: Seed Production and Certification 2(1+1)

Why this course?
Seed is the essence of life. Its improvement, production and maintenance is an essential feature of any variety. Seed chain concept is highly relevant in commercial promotion of new varieties whereas process of certification is mandatory for quality assurance of seed.

Aim of the course
To impart knowledge on principles of seed production and certification. This will help the students to understand seed production practices and seed certification procedures in different crops.

Theory
Unit I
Importance of seed as basic input in agriculture; Seed quality concept and importance; Generation system of seed multiplication -Varietal replacement rate, Seed multiplication ratios, Seed replacement rate, Seed renewal period and seed demand and supply; Various factors influencing seed production –Physical and Genetic purity in seed production; Factors responsible for varietal and genetic deterioration.

Unit II
Nucleus seed production and its maintenance - Maintenance of parental lines of hybrids, Production of breeder, foundation and certified seed and their quality maintenance; Principles of seed production in self- and cross-pollinated crops; Hybrid seed production - system and techniques involved in Seed village concept; Organic seed production and certification. Principles of seed production in field crops; Floral structure, pollination mechanism and seed production techniques in self- and cross-pollinated cereals and millets.

Unit III
Floral structure, pollination mechanism and methods and techniques of seed production in major pulses and oilseed crops; Varietal and hybrid seed production techniques in Pigeon pea, Mustard, Castor and Sunflower. Floral structure, pollination mechanism and methods and techniques of seed production in major commercial fibres. Hybrid-seed production techniques in major vegetatively propagated crops.

Unit IV
Seed certification - history, concept, objectives;Central seed certification board Seed certification agency/ organization and staff requirement; Legal status - Phases of seed certification, formulation, revision and publication of seed certification standards; Minimum Seed Certification Standards (MSCS) for different crops - General and specific crop standards, Field and seed standards; Planning and management of seed certification programs; Eligibility of a variety for certification, area assessment, cropping history of the seed field.

Practical

- Planting design for variety- hybrid seed production techniques, planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony;
- Identification of rogues and pollen shedders, supplementary pollination, detasseling, hand emasculation and pollination;
- Pollen collection and storage methods, pollen viability and stigma receptivity;
- Pre-harvest sanitation, maturity symptoms, harvesting techniques;
- Visits to seed production plots - visit to seed industries;
- Planning for seed production: cost benefit ratio, seed multiplication ratio and seed replacement rate;
- General procedure of seed certification, identification of weed and other crop seeds as per specific crops, field inspection at different stages of a crop and observations recorded on contaminants and reporting of results, inspection and sampling, harvesting/ threshing, processing and after processing for seed law enforcement;
- Specifications for tags and labels to be used for certification purpose.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completing this course the student will be able to know about seed production of different crop varieties and hybrids, their processing, marketing and seed laws.

Suggested Reading

Agrawal PK and Dadlani M. 1987. *Techniques in Seed Science and Technology*, South Asian Publishers, Delhi.

Agrawal RL. 1997. *Seed Technology,* Oxford & IBH Publishing.

Anon, 1965. *Field Inspection Manual and Minimum Seed Certification Standards*, NSC Publication, New Delhi.

Anon. 1999. *Manual of Seed Certification procedures.* Directorate of Seed Certification, Coimbatore, Tamil Nadu.

Joshi AK and Singh BD. 2004. *Seed Science and Technology*, Kalyani Publishers, New Delhi.

Kelly AF. 1988. *Seed Production of Agricultural Crops*. John Wiley, New York.

Mc Donald MB and Copeland LO. 1997. *Seed Science and Technology*, Scientific Publisher, Jodhpur.

Ramamoorthy K, Sivasubramaniam K and Kannan M. 2006. *Seed Legislation in India*. Agrobios (India), Jodhpur, Rajasthan.

Singhal NC. 2003. *Hybrid Seed Production in Field Crops*, Kalyani Publications, New Delhi

Tunwar NS and Singh SV. 1988. *Indian Minimum Seed Certification Standards*. Central Seed Certification Board, Ministry of Agriculture, New Delhi.

e-Resources

www.gov.mb.ca
www.agricoop.nic.in
www.agri.nic.in
www.fao.org
www.seednet.gov.in

GPB 511: Crop Breeding I (*Kharif* Crops) 3(2+1)

Why this course?
Botanical features, reproductive systems, genetics involved and important breeding techniques are essential to undertake any crop improvement programme. This course is designed for important/ major *Kharif* field crops.

Aim of the course
To provide insight into recent advances in improvement of kharif cereals, legumes, oilseeds, fibre, sugarcane and vegetative propagated crops using conventional and modern biotechnological approaches.

Theory
Unit I
Rice: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Aerobic rice, its implications and drought resistance breeding.
Maize: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement- QPM and Bt maize – strategies and implications.
Small millets: Evolution and distribution of species and forms - wild relatives and germplasm; Cytogenetics and genome relationship - breeding objectives yield, quality characters, biotic and abiotic stress resistance, etc.
Pigeon pea: evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.*;* Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement - Hybrid technology; maintenance of male sterile, fertile and restorer lines, progress made at National and International institutes.

Unit II
Groundnut: Origin, evolution mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship, breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.
Other pulses: Urdbean, mungbean, cowpea,: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship, breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), released varieties, examples of MAS used for improvement. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.

Soybean: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.
Castor and Sesame: Origin, evolution mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), released varieties, examples of MAS used for improvement; Hybrid breeding in castor – opportunities, constraints and achievements.

Unit III
Cotton: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Development and maintenance of male sterile lines – Hybrid development and seed production – Scenario of Bt cottons, evaluation procedures for Bt cotton.
Jute: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.
Sugarcane: Evolution and distribution of species and forms, wild relatives and germplasm; Cytogenetics and genome relationship – Breeding objectives- yield, quality characters, biotic and abiotic stress resistance, etc.
Forage crops: Evolution and distribution of species and forms – Wild relatives and germplasm; Cytogenetics and genome relationship; Breeding objectives- yield, quality characters and palatability studies; Biotic and abiotic stress resistance, etc.

Unit IV
Seed spices: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement; Achievements of important spice crops.

Practical
- Floral biology, emasculation, pollination techniques in rice, maize, pigeon pea, soybean, sesame, cotton;
- Study of range of variation for yield and yield components;
- Study of segregating populations in cereal, pulses and oilseed crops;
- Learning on the crosses between different species; attempting crosses between black gram and green gram;
- Evaluating the germplasm of cotton for yield, quality and resistance parameters, learning the procedures on development of Bt cotton;
- Visit to Cotton Technology Laboratory and Spinning Mills;

- Learning on the Standard Evaluation System (SES) and descriptors; Use of software for database management and retrieval;
- Practical learning on the cultivation of fodder crop species on sewage water, analysing them for yield components and palatability;
- Laboratory analysis of forage crops for crude protein, digestibility percent and other quality attributes;
- Visit to animal feed producing factories;
- Learning the practice of value addition; Visiting the animal husbandry unit and learning the animal experiments related with palatability and digestibility of fodder.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completing this course, the student will be able to know about important botanical status and reproductive structures of crops and genetics of important
kharif field crops.

Suggested Reading

Agarwal RL. 1996. *Identifying Characteristics of Crop Varieties*. Oxford & IBH.

Bahl PN and Salimath PM. 1996. *Genetics, Cytogenetics and Breeding of Crop Plants*. Vol. I. *Pulses and Oilseeds*. Oxford & IBH.

Chandraratna MF. 1964. *Genetics and Breeding of Rice*. Longmans.

Chopra VL and Prakash S. 2002. *Evolution and Adaptation of Cereal Crops*. Oxford & IBH.

Gill KS. 1991. *Pearl Millet and its Improvement*. ICAR.

IRRI. 1964. *Rice Genetics and Cytogenetics*. Elsevier.

IRRI. 1986. *Rice Genetics*. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines.

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IRRI. 2000. *Rice Genetics IV*. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines.

Jennings PR, Coffman WR and Kauffman HE. 1979. *Rice Improvement*. IRRI, Los Banos, Manila, Philippines.

Kannaiyan S, Uthamasamy S, Theodore RK and Palaniswamy S. 2002. *New Dimensions and Approaches for Sustainable Agriculture*. Directorate of Extension Education, TNAU, Coimbatore.

Murty DS, Tabo R and Ajayi O. 1994. *Sorghum Hybrid Seed Production and Management*. ICRISAT, Patancheru, India.

Nanda JS. 1997. *Manual on Rice Breeding*. Kalyani Publishers.

Parthasarathy VA. 2017. *Spices and Plantation Crops Vol.1* (*Part A*) *Breeding of Horticultural Crops* Vol.1 (Part-B), Today and Tomorrow Printers and Publishers

Poehlman, JM. 1987. *Breeding of Field Crops*. AVI Publishing Co. Inc. East Post Connecticut, USA.

Ram HH and Singh HG. 1993. *Crop Breeding and Genetics*. Kalyani.

Sharma, AK. 2005. *Breeding Technology of Crop Plant*. Yesh Publishing House, Bikaner

Slafer GA. (Ed.). 1994. *Genetic Improvement of Field Crops*. Marcel Dekker.

Singh HG, Mishra SN, Singh TB, Ram HH and Singh DP. (Eds.). 1994. *Crop Breeding in India*. International Book Distributing Co.

Walden DB. 1978. *Maize Breeding and Genetics*. John Wiley & Sons.

GPB 512: Crop Breeding-II (*Rabi* Crops) 3(2+1)

Why this course?
Botanical features, reproductive systems, genetics involved and important breeding techniques are essential to undertake any crop improvement programme. This course is designed for important/ major Rabi field crops.

Aim of the course
To provide insight into recent advances in improvement of *Rabi* cereals, legumes, oilseeds, fibre and vegetative propagated crops using conventional and modern biotechnological approaches

Theory
Unit I
Wheat: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.
Oats: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.
Barley: Origin, evolution, center of origin, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.

Unit II
Chickpea: Origin, evolution mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.
Other pulses: Lentil, field pea, Rajma, Horse gram: Origin, evolution, mode of reproduction, chromosome number; Genetics. cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.
Rapeseed and Mustard: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives; yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Oil quality, Improvement for oil quality.

Unit III

Sunflower, Safflower: Origin, mode of reproduction, chromosome number; Genetics, cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.

Mesta and minor fibre crops: Origin, mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.

Unit IV

Forage crops: Origin, evolution mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance.

Seed spices: Origin, evolution, mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, scope of heterosis breeding, released varieties, examples of MAS used for crop improvement.

Practical

- Floral biology, emasculation and pollination techniques in wheat, oats, barley, chickpea, rajma, rapeseed mustard, sunflower;
- Study of range of variation for yield and yield components;
- Study of segregating populations in cereal, pulses and oilseed crops;
- Use of descriptors for cataloguing; Learning on the crosses between different species;
- Trait based screening for stress resistance;
- Learning on the Standard Evaluation System (SES) and descriptors;
- Use of software for database management and retrieval.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completion of this course the student will be able to know about the different breeding methods and genetics of major *Rabi* field crops.

Suggested Reading

Agarwal RL. 1996. *Identifying Characteristics of Crop Varieties*. Oxford & IBH.

Bahl PN and Salimath PM. 1996. *Genetics, Cytogenetics and Breeding of Crop Plants*. Vol. I. *Pulses and Oilseeds*. Oxford & IBH.

Gupta SK. 2012. *Technological Innovations in Major World Oil crops*. Vol. I. Springer, USA.

Gupta SK. 2012. *Technological Innovations in Major World Oil crops*. Vol. II. Springer, USA.

Gupta SK. 2016. *Breeding of Oilseed Crops for Sustainable Production*. Academic Press, USA.

Kannaiyan S, Uthamasamy S, Theodore RK and Palaniswamy S. 2002. *New Dimensions and Approaches for Sustainable Agriculture*. Directorate of Extension Education, TNAU, Coimbatore.

Parthasarathy VA. 2017. *Spices and Plantation Crops* Vol.1 (Part A) *Breeding of Breeding and Genetics*. John Wiley & Sons.

GPB 513: Breeding Vegetable Crops 3(2+1)

Why this course?
This course enables the students to learn about breeding objectives, methodologies and genetics involved for the improvement of major vegetable crops.

Aim of the course
To educate about principles and practices adopted for breeding of vegetable crops.

Theory
Unit I
Breeding for Leafy vegetables: Amaranth, chenopods and lettuce.

Unit II
Breeding for Cucurbits: Gourds, melons, pumpkins and squashes.
Breeding for Solanaceae: Potato and tomato, eggplant, hot pepper, sweet pepper

Unit III
Breeding for Cole crops: Cabbage, cauliflower, broccoli and knol khol.
Breeding for Root vegetables: Carrot, beetroot, radish, sweet potato and tapioca.

Unit IV
Breeding for other vegetable crops: Peas, beans, onion, garlic and okra.

Practical
- Selection of desirable plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm;
- Hybridization and handling segregating generations;
- Induction of flowering, palynological studies, selfing and crossing techniques in vegetable crops;
- Hybrid seed production of vegetable crops in bulk;
- Screening techniques for insect-pests, disease and environmental stress resistance in vegetable crops;
- Demonstration of sib-mating and mixed population;
- Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques;
- Visit to breeding blocks, MAS for incorporating traits governed by major and polygenes.

PEDAGOGY (Teaching methods/activities)
- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completion of this course the students will be able to know about the different breeding methods and genetics of major vegetable crops.

Suggested Reading

Allard RW. 1999. *Principles of Plant Breeding*. John Wiley & Sons.

Fageria MS, Arya PS and Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani Publishers, New Delhi.

Kalloo G. 1988. *Vegetable Breeding*. Vols. I-III. CRC Press.

Kalloo G. 1998. *Vegetable Breeding*. Vols. I-III (Combined Ed.). Panima Edu. Book Agency.

Peter KV and Pradeep KT. 2008. *Genetics and Breeding of Vegetables.* ICAR.

Rai N and Rai M. 2006. *Heterosis Breeding in Vegetable Crops*. New India Publication Agency.

Ram HH. 2005. *Vegetable Breeding-Principles and Practices*. Kalyani Publishers

Sharma JP. 2010. *Principles of Vegetable Breeding*. Kalyani Publishers, New Delhi.

Singh BD. 1983. *Plant Breeding*. Kalyani Publishers

GPB 514: Breeding Fruit Crops 3(2+1)

Why this course?
This course is aimed to educate the students about the breeding strategies and avenues in Fruit crops.

Aim of the course
To educate students about principles and practices adopted for breeding of fruit crops.

Theory
Unit I
Fruit crop breeding: History, importance of fruit breeding, centers of diversity, distribution, domestication and adaptation of commercially important fruits.

Unit II
Issues in fruit crop breeding – heterozygosity, polyploidy, polyembryony, parthenocarpy and seed lessness, incompatibility and sterility systems.

Unit III
Apomixis - merits and demerits, types, variability for economic traits, role of genetic engineering and biotechnology in improvement of fruit crops.

Unit IV
Crop improvement in Mango, Banana, Citrus, Grapes, Papaya, Sapota and Pomegranate, Pineapple and Guava, Apple and other Rosaceous crops and region specific fruit crops.

Practical
- Germplasm documentation;
- Floral biology of mango, guava, citrus, grape, pomegranate, pollen viability in major fruit crops;
- Pollen germination to study time of anthesis and stigma receptivity;
- Hybridization technique in important fruit crops, hybrid seed collection and raising;
- Colchicine treatment for induction of polyploidy;
- Exposure to resistance breeding and screening techniques;
- Mutation breeding practices raising and evaluation of segregating populations;
- Use of mutagens to induce mutations and polyploidy;
- Visit to Biotechnology Lab and study of *in-vitro* breeding techniques.

PEDAGOGY (Teaching methods/activities)
- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completion of this course the students will be able do the breeding of fruit crops through various conventional and biotechnological methods besides mutation breeding.

Suggested Reading

Bhojwani SS and Razdan MK. 2006. *Plant Tissue Culture -Theory and Practice*. Elsevier Publication, Amesterdam.

Chadha KL and Pareek, OP. 1996. (Eds.). *Advances in Horticulture.* Vol. I to IV. Malhotra Publ. House, New Delhi.

Chadha KL and Shikhamany SD. 1999. *The Grape: Improvement, Production and Post-Harvest Management*. Malhotra Publ. House, New Delhi.

Janick and Moore JN. 1996. *Advances in Fruit Breeding*, AVI Pub., USA.

Janick J and Moore JN. 1996. *Fruit Breeding*. Vols. I to III. John Wiley & Sons.

Kumar N. 2006. *Breeding of Horticultural Crops - Principles and Practices*. New India Publishing Agency, New Delhi.

Moore JN and Janick Jules. 1996. *Methods in Fruit Breeding*. Purdue University Press, South Campus Court D., USA.

Parthasarathy VA, Bose TK, Deka PC, Das P, Mitra SK. and Mohanadas S. 2001. *Biotechnology of Horticultural Crops.* Vols. I-III. Naya Prokash, Kolkata.

Ray PK. 2002. *Breeding of Tropical and Sub-tropical Fruits*. Narosa Publishing House, New Delhi.

Simmonds NW. 1976. *Evolution of Crop Plants*, Orient Longman, London.

GPB 515: Breeding Ornamental Crops 3(2+1)

Why this course?
The course will impart knowledge to student about breeding of Ornamental Crops through conventional and biotechnological interventions.

Aim of the course
To educate about principles and practices adopted for breeding of ornamental crops.

Theory
Unit I
History of improvement of ornamental plants; Centre of origin of ornamental crop; Objectives and techniques in ornamental plant breeding.

Unit II
Introduction, selection, hybridization, mutation and biotechnological techniques for improvement of ornamental and flower crops, viz., Rose, Jasmine, *Chrysanthemum*, Tuberose, *Gerbera*, *Gladiolus*, *Dahlia*, *Lilium*, *Gaillardia*, *Petunia*, *Bouganvillea*, Pansy, Marigold, *Geranium*, *Antirrhinum*, China aster, Orchids, *Carnation*, *Hibiscus*, etc.

Unit III
Development of promising cultivars of important ornamental and flower crops; Role of Heterosis and its exploitation, production of F1 hybrids and utilization of
male sterility.

Unit IV
Production of open pollinated seeds, harvesting, processing and storage of seeds; Seed certification.

Practical
- Study of floral biology and pollination in important species and cultivars of ornamental crops;
- Techniques of inducing polyploidy and mutation;
- Production of pure and hybrid seed;
- Methods of breeding suited to seed propagated plants;
- Polyploidy and mutations to evolve new varieties;
- Breeding methods for biotic and abiotic stresses;
- Visit to research institutes involved in ornamental crop breeding.

PEDAGOGY (Teaching methods/activities)
- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completion of this course the students will be able to do the breeding of ornamental crops by conventional breeding and biotechnological methods and to know the genetics of major ornamental crops.

Suggested Reading

Alexander V. 2002. *Breeding for ornamentals: Classical and Molecular Approaches*. Kluwer Academic Publishers, London.

Allard RW. 1999. *Principles of Plant Breeding*. John Wiley & Sons. INC. New York.

Bhattacharjee SK and De LC. 2003. *Advanced Commercial Floriculture* Vol. 1. Aavishkar Publishers & Distributors, Jaipur.

Bose TK and Yadav LP. 2003. *Commercial Flowers*. Naya Prokash Publishers, Kolkata.

Chadha KL and Bhattacharjee SK. *Advances in Horticulture* Vol. 12, Malhotra Publishing House, New Delhi.

Mc Donald MB and Kwong FY. 2005. *Flower Seeds Biology and Technology*, CABI Publishing, Oxfordshire, UK.

Watts L.1980. *Flower and Vegetable Plant Breeding*. Grower Books

GPB 516: Breeding for Stress Resistance and Climate Change 3(2+1)

Why this course?

Climate change is a big challenge to sustain higher crop productivity and nutritional quality. Concept of breeding for stress tolerance and development of hybrids/ varieties for climate change is of prime importance in plant breeding. Therefore this course is essential for budding plant breeders.

Aim of the course

To apprise about various abiotic and biotic stresses influencing crop yield, mechanisms and genetics of resistance and methods to breed stress tolerant varieties.

Theory

Unit I

Concept and impact of climatic change; Importance of plant breeding with special reference to biotic and abiotic stress resistance; Classification of biotic stresses – major pests and diseases of economically important crops. Concepts of resistance to insect and pathogen resistance; Analysis and inheritance of resistance variation; Host defence responses to pathogen invasions- Biochemical and molecular mechanisms; Acquired and induced immunity and systemic acquired resistance (SAR);

Unit II

Host-pathogen interaction, gene-for-gene hypothesis, molecular evidence for its operation and exceptions; Concept of signal transduction and other host-defence mechanisms against viruses and bacteria. Types and genetic mechanisms of resistance to biotic stresses –Horizontal and vertical resistance in crop plants; Quantitative resistance/ adult plant resistance and slow rusting resistance; Classical and molecular breeding methods – Measuring plant resistance using plant fitness; Behavioural, physiological and insect gain studies; Phenotypic screening methods for major pests and diseases; Recording of observations; Correlating the observations using marker data – Gene pyramiding methods and their implications.

Unit III

Classification of abiotic stresses - Stress inducing factors, moisture stress/ drought and water logging and submergence; Acidity, salinity/ alkalinity/ sodicity; High/ low temperature, wind, etc.; Stress due to soil factors and mineral toxicity; Physiological and Phenological responses; Emphasis of abiotic stresses in developing breeding methodologies. Genetics of abiotic stress resistance; Genes and genomics in breeding cultivars suitable to low water regimes and water logging and submergence, high and low/ freezing temperatures;

Unit IV

Utilizing MAS procedures for identifying resistant types in important crops like rice, sorghum, wheat, cotton, etc.; Breeding for resistance to stresses caused by toxicity, deficiency and pollutants/ contaminants in soil, water and environment. Use of crop wild relatives as a source of resistance to biotic and abiotic factors in major field crops; Transgenics in management of biotic and abiotic stresses, use of toxins, protease inhibitors, lectins, chitinases and Bt for diseases and insect pest management.

Practical

- Understanding the climatological parameters and predisposal of biotic and abiotic stress factors- ways of combating them for diseases caused by fungi and bacteria;
- Symptoms and data recording; use of MAS procedures;
- Phenotypic screening techniques for sucking pests and chewing pests – Traits to be observed at plant and insect level;
- Phenotypic screening techniques for nematodes and borers; Ways of combating them;
- Evaluating the available populations like RIL, NIL, etc. for pest resistance;
- Use of standard MAS procedures. Breeding strategies - Weeds – ecological, environmental impacts on the crops;
- Breeding for herbicide resistance;
- Screening crops for drought and flood resistance; factors to be considered and breeding strategies;
- Screening varieties of major crops for acidity and alkalinity- their effects and breeding strategies;
- Screening forage crops for resistance to sewage water and tannery effluents; Quality parameters evaluation.

PEDAGOGY (Teaching methods/activities)

- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After completion of this course the student will be able to well verse with the stress and its causes. This will enable the students for the development of RIL, NIL, etc. for pest resistance and Use of standard MAS procedures

Suggested Reading

Blum A. 1988. *Plant Breeding for Stress Environments*. CRC Press.

Christiansen MN and Lewis CF. 1982. *Breeding Plants for Less Favourable Environments*. Wiley International.

Fritz RS and Simms EL. (Eds.). 1992. *Plant Resistance to Herbivores and Pathogens: Ecology, Evolution and Genetics*. The University of Chicago Press.

Li PH and Sakai A. 1987. *Plant Cold Hardiness*. Liss, New York Springer

Luginpill P. 1969. *Developing Resistant Plants - The Ideal Method of Controlling Insects*. USDA, ARS, Washington DC.

Maxwell FG and Jennings PR. (Eds.). 1980. *Breeding Plants Resistant to Insects*. John Wiley & Sons. Wiley-Blackwell.

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Russel GE. 1978. *Plant Breeding for Pest and Disease Resistance*. Butterworths.

Sakai A and Larcher W. 1987. *Frost Survival in Plants*. Springer-Verlag.

Singh BD. 2006. *Plant Breeding*. Kalyani Publishers, New Delhi.

Turener NC and Kramer PJ. 1980. *Adaptation of Plants to Water and High Temperature Stress*. John Wiley & Sons.

van der Plank JE. 1982. *Host-Pathogen Interactions in Plant Disease*. Academic Press.

GPB 517: Germplasm Characterization and Evaluation 2(1+1)

Why this course ?
Students need to learn about morphological and quality agronomic traits of accessions as well as their reaction to biotic and abiotic stresses. This will increase the importance of the germplasm.

Aim of the course
Students will gain knowledge on germplasm characterisation, evaluation and documentation of information. Recording of morphological and agronomic traits, including quality, as well as those for resilience to biotic and abiotic stresses that will promote utilisation. Exposure to development of web based tools for systematic description for efficient use of germplasm.

Theory
Unit I
Understanding genetic diversity in crop plants; Crop descriptors, descriptor states; germplasm characterization/ evaluation procedures; evaluation of germplasm for specific traits; Measuring diversity using agro-morphological data, statistical procedures to measure population genetic variation, markers and their use in PGR, evaluation of biotic and abiotic stresses,

Unit II
Principles and methods for formulating core and mini core collections and their validation, Web based tools for management of data. Principles and practices of germplasm regeneration and maintenance, breeding systems and mode of reproduction; maintaining sufficiently large populations for effective conservation of farmer landraces, evaluation and maintenance of wild relatives of crop plants.

Unit III
Genetic enhancement, Use of CWRs genetic resources for crop improvement.
High throughput phenotyping systems- imaging and image processing concepts for automated germplasm characterization (phenotyping) –

Unit IV
Evaluation for nutritional traits, resistance traits -Biochemical and molecular markers for characterization.

Practical
- Field layout and experimental designs;
- Recording field data on germplasm evaluation in different agri-horticultural crops,
- post harvest handling;
- Evaluating quality traits, biochemical and phyto-chemical evaluation of crop germplasm, data processing;
- Documentation, analysis of diversity and cataloguing, data analysis, viability equations, sampling strategies, data documentation, cataloguing, biochemical analyses of samples.

PEDAGOGY (Teaching methods/activities)

- Lectures
- Power point presentations
- assignments, quiz
- Group tasks, student's presentations

Learning Outcome

To educate students about science of managing genetic resources including principles involved in maintaining genetic integrity during regeneration, germplasm characterization and evaluation.

Suggested Reading

Brown AHD, Clegg MT, Kahler AL, Weir BS (eds.) 1990. *Plant Population Genetics, Breeding, and Genetic Resources*, Sinauer Associates, USA.

Frankel R and Galun E 1977. *Pollination Mechanisms, Reproduction and Plant Breeding. Monographs on Theoretical and Applied Genetics*, Springer-Verlag, Berlin, Heidelberg.

Hayward MD, Bosemak NO and Romagosa I. 1993. *Plant Breeding: Principles and Practices*, Chapman & Hall.

Holden JHN and Williams JT 1984. *Crop genetic resources: conservation and evaluation*, IBPGR.

Puzone, L and Th. Hazekamp 1996. *Characterization and Documentation of Genetic Resources Utilizing Multimedia Database*. NBPGR, New Delhi.

Rana RS, Sapra RL, Agrawal RC and Gambhir R 1991. Plant Genetic Resources, *Documentation and Information Management*. NBPGR, New Delhi.

Stoskopf NC 1993. *Plant Breeding: Theory and Practice*, Westview Press.

Sundeep Kumar, *et al.* 2016. *Evaluation of 19,460 wheat accessions conserved in the Indian national gene bank to identify new sources of resistance to rust and spot blotch diseases*. PloS One Vol 11, pages 0167702.

Tripathi K, Bhardwaj R, Bhalla S, Kaur V, Bansal R, Yadav R, Gangopadhyay KK, Kumar A and Chaudhury R. 2018. *Plant Genetic Resources Evaluation: Principles and Procedures*, Indian Council of Agricultural Research - National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi. vi+50 p.

GPB 518: Genetic enhancement for PGR Utilization 2(1+1)

Why this course ?

Pre-breeding is a vital step in the link between plant genetic resources conservation and its use; Hence, this course is designed to inculcate theoretical and practical know how to understand and use classical and advanced plant breeding methods for planning and execution of prebreeding programmes so that the PGR is put into effective use for food and agriculture.

Aim of the course

To teach theoretical and practical know how on CWRs reproductive behavior, acclimatization and adaptation for utilization in pre-breeding programmes using advanced tools.

Theory

Unit I

Concepts of gene pools; Introduction, potential of pre-breeding. Role of crop wild relatives, semi exotics, creating and managing variation, basic concepts to set up a successful pre-breeding programme.

Unit II

Understanding crop adaptation, handling and maintenance of CWRs, synchronization of flowering, overcoming impediments to flowering through photoperiodic adjustments, role of other barriers to flowering, role of amphidiploids, semi exotics and other unadapted germplasm, identifying desirable traits in natural populations, screening for biotic and abiotic stress resistance traits; screening of nutritionally important traits, genetic analysis to understand the inheritance of novel traits.

Unit III

Parental selection for prebreeding, search for superior genotypes, breeding methods for trait transfer; moving the genes - unadapted to adapted, wide hybridization,

Unit IV

Incongruity and its management, modern tools for incongruity management, cytogenetical approaches for gene transfer such as alien addition and substitution, segregating populations and their management in wide crosses, purging the undesirable traits, testing and improving the adaptability of wide cross derivatives, cytological studies, florescence microscopy, embryo rescue methods, pollen physiology and storage, pollen storage methods to facilitate wide hybridization, pre- and postzygotic barriers.

Practical

- Characterization of CWRs by visiting the fields;
- Screening methods for special traits-biotic and abiotic resistance;
- Screening for nutritional traits;
- Crossability studies in CWRs of cereals, legumes, oilseeds, vegetables. Assessment of pre and post-zygotic barriers in wide hybridization crosses;
- Pollen storage studies;
- Special requirements for growing CWRs, inducing flowering by manipulating day length, temperature, chemical spraying, etc.

PEDAGOGY (Teaching methods/activities)

- Lectures
- Power point presentations
- assignments, quiz
- Group tasks, student's presentations

Learning outcome

Students would be conversant with handling of unadapted germplasm, screening methods for special traits-biotic and abiotic resistance, nutritional traits, characterization of CWR, breeding, etc.

Suggested Reading

Andey Pereira. 2006. *Plant Reverse Genetics*, Methods and Protocols, Humana Press

Bisht *et al*. 2004. Broadening the genetic base of sesame (*Sesamum indicum* L.) through genetic enhancement. *Plant Genetic Resources* **2(**3): 143–151.

Dale JW and von Schantz M. 2007. *From genes to genomes. Concepts and applications of DNA technology*. John Wiley & Sons Ltd., Chichester, England.

Duvick DN. 1990. Genetic enhancement and plant breeding. p. 90–96. In: J. Janick and J.E. Simon (eds.), Advances in new crops. Timber Press, Portland.

Goodman, RM. 2004. *Encyclopedia of plant and crop science*. Marcel Dekker Inc., Switzerland.

Kimber, G and Feldman, M. 1987. *Wild Wheat: An introduction*. Special report 353, College of Agriculture, University of Missouri-Columbia.

Lynch M. and Walsh B. 1998. *Genetics and analysis of quantitative traits*. Sinauer Associates Inc., MA, USA.

Murphy D. 2007. *Plant breeding and biotechnology: Societal context and the future of agriculture*. Cambridge University Press, Cambridge, UK.

Ram JS. 2010. *Plant Cytogenetics*. CRC Press.

Ramanatha Rao V, Brown AHD, Jackson M. 2001. *Managing Plant Genetic Diversity*. CABI publication.

Sharma S, Upadhyaya HD, Varshney RK, *et al*. 2013. Pre-breeding for diversification of primary gene pool and genetic enhancement of grain legumes. *Front. Plant Sci*. **4**: 309.

Yunbi Xu. 2010. Molecular plant breeding, CABI publishers

e-Resources

https://www.integratedbreedPlaning.net/ pre-breeding-effective-use-plant-genetic-resources
http://www.croptrust.org/
http://www.bioversityinternational.org/training/training_materials/pre_breeding.htm
http://www.grdc.com.au/director/research/prebre

GPB 519: Population Genetics 2(2+0)

Why this course?
Population improvement programmes are the basis of genetic enhancement in cross pollinated crops. This course is needed to make the students aware about the population genetics and its role in crop improvement.

Aim of the course
To impart knowledge on structure, properties and their breeding values of different population.

Theory
Unit I
Population: Properties of population, Mendelian population; Genetic constitution of a population through time, space, age structure, etc.; Frequencies of genes and genotypes; Causes of change: population size, differences in fertility and viability, migration and mutation.

Unit II
Hardy-Weinberg equilibrium, Hardy-Weinberg law, Proof and applications of the Hardy-Weinberg law, Test of Hardy-Weinberg equilibrium; Mating frequencies: Non-dominance, Codominance, Snyder's ratio, importance and its effect over random mating in succeeding generations.

Unit III
Multiple alleles, More than one locus, Sex linked genes; Use of gene and genotypic frequencies evaluation in field population level; Interpretations - Changes of gene frequency, Migration, Mutation, Recurrent and non-recurrent Selection; Balance between selection and mutation; Selection favoring heterozygotes; Overdominance for fitness.

Unit IV
Mating systems, Random mating population, Nonrandom mating: selfing –inbreeding coefficient, panmictic index, sibmating, Assortative mating and disassortative mating; Pedigree populations and close inbreeding, Estimation of linkage disequilibrium, Correlation between relatives and estimation of F; Effect of inbreeding and sibbing in cross pollinated crops; Gene substitution and average effects; Breeding value- Genetic drift; Genetic slippage, Co-adapted gene complexes; Homoeostasis- Adaptive organization of gene pools; Polymorphism- Balanced and Non-balanced polymorphism, heterozygous advantage- Survival of recessive and deleterious alleles in populations.

PEDAGOGY (Teaching methods/activities)
- Power point presentation
- Chalk and Board
- Smart board
- Lectures
- Assignments, quiz
- Group tasks, student's presentations

Learning outcome

After the completion of this course the student will be well versed with population genetics, its components and applications in crop improvement.

Suggested Reading

Chawla V and Yadava RK. 2006. *Principles of Population Genetics – A Practical Manual*. Dept. of Genetics, CCS HAU Hisar.

Falconer DS and Mackay J. 1996. *Introduction to Quantitative Genetics*. Longman.

Jain JP, Jain J and Parbhakaran VT. 1992. *Genetics of Populations*. South Asia Books.

Li CC. 1955. *Population Genetics*. The Univ. of Chicago Press.

Mather K and Jinks JL. 1982. *Biometrical Genetics*. Chapman & Hall.

Sorrens D and Doniel G. 2007. *Methods in Quantitative Genetics*. Series: *Statistics for Biology and Health*. Likelihood.

Tomar SS. 1992. *Text Book of Population Genetics*. Universal Publication.

PATTERN OF QUESTION PAPER FOR THE THEORY EXAMINATION

M.Sc. (Agri.) in Genetics & Plant Breeding
(Semester Scheme - CBCS Pattern)

Time: 3 Hours Max. Marks: 70

Instructions: Answer all the questions.

SECTION – A: Define/explain ANY FIVE of the following: 5 x 2 = 10

(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)

1)

2)

3)

4)

5)

6)

7)

SECTION-B: Write short notes on ANY FOUR of the following: 4 x 5 = 20
(Questions from all the Units of the Syllabus by drawing minimum of one question from each unit)
8)

9)

10)

11)

12)

13)

SECTION-C: Explain in detail on ANY FOUR of the following: 4 x 10 = 40
(Questions from all the Units of the Syllabus by drawing minimum of one question form each unit)
14)

15)

16)

17)

18)

19)

Signature of the BOS Chairman