

T.R. Rahangdale

ANNEXURE/M.Sc.Botany/SYLLABUS

SANT GHIRA GURU VISHWAVIDYALAYA SARGUJA AMBIKAPUR (C.G.)



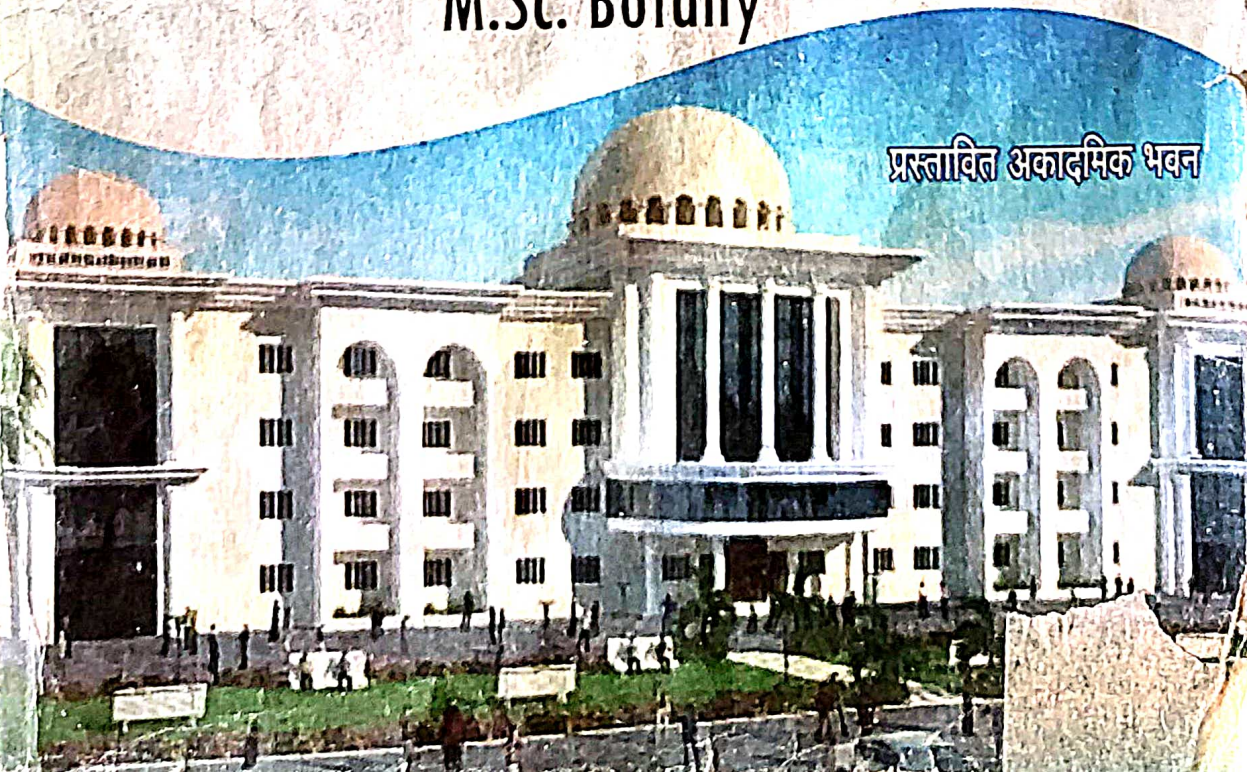
CHOICE BASED CREDIT SYSTEM
(CBCS)

2018-19

Syllabus

M.Sc. Botany

प्रस्तावित अकादमिक भवन



BOTANY
SANT GAHIRA GURU VISHWAVIDYALAYA
Sarguja Ambikapur (C.G.)

CHOICE BASED CREDIT SYSTEM
(CBCS)

SYLLABUS
M.Sc. BOTANY

SEMESTER SYSTEM
SESSION 2018-19



For Affiliated Colleges of
SANT GAHIRA GURU VISHWAVIDYALAYA
Ambikapur (C.G.) -497001

**SANT GAHIRA GURU VISHWAVIDYALAYA
SARGUJA, AMBIKAPUR (C.G.)**

**SANT GAHIRA GURU ORDINANCE 46:
MASTER DEGREE (P.G.) PROGRAMMES**

PROPOSED DRAFT ORDINANCE 46:

O.M.D.1.: This Ordinance shall be called "The Sant Gahira Guru Master Degree (Semester Study) Programme with Choice based Credit System.

O.M.D.2.: This Ordinance shall come into the force from the Academic Semester 2017-18.

Notwithstanding anything in the earlier laws of the Sant Gahira Guru Master Degree Programmes in the different faculties (*Ayurveda, Commerce, Education, Fine Arts, Law Life Sciences, Medicine, Management, Science & Social Sciences*) under the "semester system", the "Semester with Choice based Credit System" shall be regulated and conducted as per the provisions of this ordinance.

O.M.D.3. Definitions:

In this Ordinance, unless the context otherwise requires:

- a. "Academic Council" means Academic Council of the University.
- b. "Administrative Grade Letter" means the alphabet indicating the administrative comment in place of Grade Letter to indicate the Credit Withdrawn (W), Unfair Means (U), Absent in SEE (X). The Administrative Grade Letter has zero Grade Point associated with it.

- c. **"Board of Studies"** means PG Board of Studies in any subject constituted under the university statutes.
- d. **"Core Course"** means the course pertaining to main subject or theme of the master programme.
- e. **"Credit"** means the unit by which the academic activity of course work is measured. In these Regulations, One Credit means one hour of Class Room Teaching per week in case of theory papers and 1.5 hours in practical / laboratory work.
- f. **"Credit Courses"** means the course classified as Compulsory Core Courses(CCC), Elective Core Courses(ECC), Seminar (SEM), Project Work(PRJ); Field Study(FST), Self Study Course(SSC), Other Supportive Courses(OSC), Educational/Study Tour (EST) and Research Publications (RPJ).
- g. **"Credit Monitoring"** means an act to monitor the credit by a Credit Monitoring Committee (CMC) consists of the Head (as Chairperson) and three senior most teachers on the Roll of the Department. In case, when the Department does not have the required number of the teachers in the department than the Vice chancellor may constitute the said committee by nominating the number of expert(s) required by the Ordinance from any other university or institute who are not below the post of Professor.
- h. **"Credit Points"** means the product of 'credits assigned to the course' and 'the Grade Point secured for the same course by the student'.
- i. **"Semester Grade Point Average (SGPA)"** means the Semester Grade Point average computed on the basis of the formula prescribed in the ordinance. It measures the performance of a student in a given Semester. The SGPA is the ratio of the 'total credit points earned by the student in all the credits earned in the concerned semester' and the 'total number of credits earned in that Semester'.

- "Cumulative Grade Point Average (CGPA)"** means the Cumulative Grade Point weightage average of SGPA computed on the basis of the formula prescribed for the entire Programme. It measures the overall performance of a student in a Master degree programme. The CGPA is the ratio of the 'total credit points earned by the student in all the credits earned in the Master degree programme' and the 'total number of credits earned in that Master degree programme'.
- k. **"Degree"** means Post Graduate Degree in any subject.
- l. **"Departmental Staff Council (DSC)"** means a Council of the Department consisting of its whole time faculty which falls in the category of teacher. The DSC will be empowered to consider and decide the academic matters, as specified in Master Degree Ordinances and Regulations.
- m. **"Elective Course"** means the course, which can be offered as 'optional subject' to the provisions of this Ordinance and the respective syllabus from inter or intra subjects and or disciplines including interdisciplinary or multidisciplinary nature.
- n. **"Fee"** means the fee prescribed by the University for the respective Master Degree Programme from time to time.
- o. **"Grade Letter"** means the alphabet indicating the performance of a student in a particular course. It is the transformation of the scaled marks secured by the student in a Course. Grade letters are O, A, B, C, D, E, and F.
- p. **"Grade Point"** means the numerical weightage allotted to each stratum of scaled marks corresponding to each 'Grade letter'.
However, the "Administrative Grade Letter" as defined will represent the categories mentioned in the OMD.3 sub clause 'b' of this ordinance.

- q. "Master Degree Programme" means a Masters Degree Programme in any subject studied at Master degree level under any faculty of the University.
- r. "Semester End Examination (SEE)" means the examination due to be conducted after the end of the respective semester.
- s. "Semester" means an academic term constituting 20(twenty) weeks. Each semester shall have at least 15 (fifteen) weeks of direct class room teaching. The Academic Year shall be of bi-semester. Odd Semesters shall be normally from mid June to mid December and Even Semesters shall be from mid December to mid June.
- t. "Student" means student admitted to Master Degree Programme in any subject being run under the University Ordinance and Regulations.

O.M.D.4.Course Structure:

1. A Master Degree programme shall consist of the duration of at least two academic years consisting four semesters. A candidate will be required to complete this programme within 4 years from the date of his/her first admission in the semester – I.

Provided that subject to the approval of the UGC Regulations, when the Master Degree Programme is of one academic year and spreads in the two academic semesters then the study has to be completed within a period of two years from the date of admission in the Semester – I.

2. Subject to the provisions of this Ordinance the programme/study shall be based on (a) Semester System Examination, (b) Continuous Assessment, (c) Choice Based Credit System, and (d) Semester Grade Point Average and Cumulative Grade Point Average Systems.

3. "Core Course' means a 'course/subject', the knowledge of which is considered essential for a student of the respective programme. This may also include elective courses.
4. 'Elective Course' allow students to acquire knowledge and skills in areas of their choice. Such course(s) may be offered by concerned department and / or other departments within the university. This may be inter or/ and intra department/institution subject to the approval by the university.
5. The Course of respective Master Degree Programme shall have following (i) Course Code(CC), (ii) Course Title (CT), (iii) Course type such as Compulsory Core Courses(CCC), Elective Core Courses(ECC), Seminar (SEM), Project Work(PRJ), Field Study(FST), Self Study Course(SSC), Other Supportive Courses(OSC), Educational/Study Tour (EST) and Research Publications(RPJ) (iv) Credits Assigned, (v) Number of Contact Hours for Lecture(L), Tutorial (T) and Practical or other (P) to be assigned per week.

S No.	Course Code	Course Title	Course Type	Credits	Contact Hours Per week		
					L	T	P

6. Fifteen (15) hours of theory teaching will lead to one credit((which means one hour per week theory teaching in a semester is equivalent to one credit) and in case of practical 45 hours of laboratory work will lead to two credits (Which means 3 hour practical classes per week in a semester is equivalent to two credits). Each semester of Master's course shall offer 30 credits or more. Number of semester of Examinations and minimum credit required to be earned for Master Degree in various post-graduate courses specified as under:

S No.	Course Code	Number of Semesters	Minimum Required Credi
1.	All Two Year Master Degree Programme	Four	120
2.	All One Year Master Degree Programme	Two	60

- **Note:** The curriculum may be described in the syllabus in form of 'Courses' or 'Papers'. The number of papers, course type and credits with detailed syllabus for each course shall be described in the 'syllabus of the respective course'. Candidate will be required to earn minimum credits prescribed for the respective Master Degree.

- 7. Each course shall be assigned a specific number of credits. A course or paper is identified by a course code designated by a string of six alphanumeric characters and a course title. In a course code the first three characters of the string indicate the Department offering the course and the later three alphanumeric characters designate a particular course. In the case of compulsory core courses (CCC) the fourth character identifies the semester numeric digit and in case of the elective core courses (ECC) the fourth character indicates the cluster of specialization. For compulsory theory core courses the fifth character is '0', for laboratory core courses it is '1' and for project/seminar it is '2' and for research publications in journals it is '3'.

- The examination shall comprise of the requirement of four (in case of one year course two) semesters and the Subjects for each semester will be as per the schedule of the structure of the Master Degree Programme with the particulars mentioned therein.

- 8. CBCS offers flexibility for effective teaching learning processes in terms of number of contact hours for Lecture (L), Tutorial (T) and Practical or other (P) to be assigned per week for a course or paper.

9. Type of courses

There shall be following categories of courses in the MASTER DEGREE Regular Programme:

9.1. Compulsory Core Course (CCC)

A course, prerequisite for a student to obtain the Degree in the concerned Programme.

9.2. Elective Core Course (ECC)

A course, which is to be chosen by the student from a pool of courses offered by the Department.

9.3. Other Supportive Course (OSC)

Subject to the availability of the course and provisions of university rules, a student admitted in a Master Degree programme shall have option to offer **Other Supportive Courses** including **Interdisciplinary (ID)/Multidisciplinary (MD)** course/s offered by a Department/cluster of Departments. For formation of a Master, two or more Departments shall come together for offering MD courses depending on their available expertise and infrastructure. The Departmental Staff Council (DSC) shall be competent to decide the nature and scope and number of such courses to be offered by the concerned Department in collaboration with other Department/s.

9.4. Self Study courses (SSC)

Since one of the main objectives of the CBCS is to enable the students to learn on their own. The Self Study course(s) shall be offered to realize this objective. A list of Self Study course(s) shall be designed by different faculty of the Department and after the approval of the DSC, the course(s) shall be made available to the students for self study. Such a course(s) shall have advisory academic support of the faculty, who proposed the course, and the same faculty shall evaluate the student at the end of the semester for a Course Report of 50 marks and a viva voce examination of 50 marks. The number of credits that can be earned in a semester in SSC shall be limited to 4.

• 9.5. Seminar (SEM):

The aim of the seminar is to give students an exposure to recent developments and advance topic of research interests. The seminar preparations can be undertaken only after the prior approval of the CMC of the Department. The CMC will allot Seminar Credits on merit basis out of desiring students. The said preparations will be undertaken under the guidance and supervision of a teacher of the parent department. No teacher will be allowed to guide more than three students at a time in a semester. The guiding teacher will make continuous internal assessment of the seminar. At the end of the 'Semester End Examination' the seminar will be conducted and credits will be awarded by a Board of three examiners consisting of the Head of the Department, guide and one faculty member other than a guide.

9.6. Project Work (PRJ) or Field Study (FST):

The aim of the Project Work or Field Work is to introduce students with the research methodology in the subject and to prepare them for pursuing research in theoretical, experimental or computational areas of the subject. The Project Work or Field Study has to be conducted under the guidance of a teacher of the concerned department or a scientist or any other suitable person with proven research excellence in the concerned field of study. One can conduct the Project Work or Field Work in an outside institution of national or international repute on the prior approval by the CMC of the department concerned.

The CMC will allot the Credits Project Work or Field Study to the desirous depending on their capacity and subject to the availability of the resources on the basis of their merit. The guiding teacher will make continuous

assessment of the Project Work or Field Study of a candidate under his/her supervision. SEE for the said Project Work or Field Study will be held at the unit where the study has been under taken by a Board of three examiners consisting of the concerned Head, Guide/Supervisor and one other senior faculty.

9.7. Education Study Tour (EST):

Subject to the provisions of the syllabus of the concerned Master degree Programme, the concerned Department may arrange educational tour/study tour. It will be compulsory on the part of student to join the same and on completion of tour; he/she will be required to submit its report to the University Department. The time spent for the purpose will be considered for computation of attendances in the respective semester/term. The Department may design & arrange the educational tour considering nature, scope & requirement of the respective subject.

The requirement of the tour has to be incorporated in the respective syllabus.

The university will determine the university contribution for tour for each student and escorting staff by administrative decision approved by the Finance Committee.

9.8. Research Publications in Journals (RPJ):

One research publication as a coauthor in a journal above impact factor 1.0 will be assigned two credits and that in other ISSN bearing journals will be assigned one credits.

10. A Master Degree study is a regular fulltime programme.

Therefore, no student admitted in the said programme will be allowed to join any other programme of study during this period. This will be obligatory for the student to ensure that he has not sought admission in any other programme during this period.

O.M.D.5.Admission:

1. A candidate, who has passed Bachelor Degree programme in the concerned subject/discipline from this university or any other university established by law and recognized by the Sant Gahira Guru for the purpose of admission in the Master Degree programme of this university shall be eligible to apply for admission in the respective Master Degree programme of this university.

Provided further that a candidate, who has passed Bachelor Degree programme from the Faculty of Arts/Social Science shall be eligible to submit his candidature for any subject of the Master degree programme(s) of the said faculties except the Master degree programme in Mathematics run under the same faculties. A candidate can apply for Master Degree in Mathematics only when he has passed Bachelor degree with subject of Mathematics either from Faculty of Social Sciences/ Science.

2. The University may prescribe further stipulation with respect to minimum qualifications subject to the approval of the Academic Authorities of the university.
3. The University may prescribe different qualifications for different courses.
4. The admissions shall be granted strictly on the basis of the merit list.
5. The Department/ University may with the previous permission of the Vice-Chancellor (including the approval of the scheme entrance test/examination), hold entrance test and /or Oral examination for admission in the respective Master degree programme of the department.
6. In case when the Department conducts Entrance Test and/ or Oral Test, the university will give at least "Fifty per cent" weightage to the marks obtained by the candidate at the concerned qualifying examination.

7. It will be obligatory for the authorities involved in the admission process to strictly observe the reservation policy in admissions formulated time to time by the Union Government or State Government, UGC, Rehabilitation Council and adopted by the University. The data based information in this regard has to be provided to the university within a period of 15 days after the completion of the admissions in the respective degree.
8. Admitting authority shall have to prepare and publish the merit list in the two fold as mentioned below:-
 - (i) Candidates, who have passed the qualifying examination indicating category against each of the name in the last column such as General/S.T./S.C./S.E.B.C./Physically Challenged/Women etc.
 - (ii) Candidates, who have passed the qualifying examination from a foreign university.
9. Admission granted by the University/Department to any student shall be provisional till the enrolment/registration/enlistment is made by the University. When the admission is granted on the bases of provisional eligibility certificate, the conditions & instructions given by the University should be complied within the time limit fixed by the University or latest by the beginning of next semester otherwise, term kept by such students will be forfeited and no fees on any account will be refunded.

O.M.D.6. Medium of Instruction and Examinations :

1. English or Hindi shall be the medium of instruction & examination.
2. No student shall be allowed to change the medium to appear in the examinations once he/she has opted any medium for particular Semester.
3. No student shall be allowed to opt or write papers with two different medium in one examination.

4. Notwithstanding anything in this ordinance the University may declare English as compulsory medium for instructions and/ or examinations for any Master Degree Course keeping academic considerations in mind

O.M.D.7.Mandatory Requirement of Attendance to appear in Examination:

1. The Choice Based Credit System (CBCS) Programme of the University is a comprehensive and continuous evaluation programme .Therefore; no students shall be allowed to appear in the examination unless he has at least 75% (seventy five per cent) attendance separately in all the papers/courses.
2. The respective term/ semester of the student shall be liable for rejection in case the attendance is short in any paper/subject due to the reasons, whatsoever.

Provided that the Vice chancellor may on the medical ground condone the requirement of attendance not exceeding 10% (ten percent) short to the required minimum attendance on the recommendation of the Head of the concerned Department, that the illness was of such a serious nature (recorded by the doctor treating him/her) that it was beyond his or her control to attend the classes during the said period. The production of false certificate in this regard will be a ground for rejection from the Master degree programme and criminal action.

Provided further that the Vice chancellor may on any other reasonable ground condone 5% (five per cent) attendance lesser than to the required 75% (seventy five per cent) to his satisfaction on the recommendation of the concerned Head of the Department.

3. A student, who represented the university/ institution/ Department/Centre/ State or Nation in Sports, N.C.C., N.S.S. Cultural or other Activities conducted and / or sponsored officially by such institution(s) or agencies shall be entitle to

relaxation of ten percent in the attendance required for the purpose. Such cases should also be recommended by the concerned Head before he/she proceeds for leave and forwarded his application with appropriate documents to prove his participation. Submission of his case without prior permission will not be considered in any case.

Explanation: The University in no case will grant relaxation in attendance to a student, separate or combined on all the heads mentioned in O.M.D. 7 exceeding 15% (fifteen percent). Therefore, no candidate, who does not have 60% (sixty) or more than 60% (sixty per cent) attendance, will not be allowed to appear in the examination for reasons and grounds whatsoever.

O.M.D.8. Advisory for Students:

Each Department shall develop 'Advisory Mechanism' to address complex nature of the issues including advice to elect the course(s) from the category of elective courses.

Each Department will appoint Advisors in appropriate number required for the purpose.

The Department may Prepare "Student Hand Book" containing the detail of the courses available at the Department. This includes both the 'Core' and 'Elective Course (s)'.

A student subject to the availability of the elective courses will be required opt course(s) and submit his 'Option in writing' in triplicate on the prescribed 'Performa' for his registration in the concerned semester to the Head of the Department immediately after the commencement of the respective semester; i.e. on or before the last date notified by the concerned department.

5. The last date for registration and permission for election of subject should not exceed more than two weeks after the commencement of the semester.
6. A student may be permitted to withdraw from his registration from two weeks from the date of the registration.
7. A student may be permitted to withdraw from/change the elective subject opted by him after the allocation. However, he/she will not be allowed to withdraw/ change the same on or before the last date fixed for exercising his/her option to opt the same. Provided further that no student will be allowed to withdraw or change the option, who has been allowed for late registration/permission or entry.

O.M.D.9. Semester Schedule:

1. A Semester shall consist of the duration of Fifteen weeks (90 working Days)
2. First Semester of each Academic year will commence from July 15th of every Academic year.
3. Mid-academic year Semester(s) will commence on the stipulated date notified by the university or within in a period of seven days after the completion of the examination of the preceding semester for those students, who fall in this category can seek provisional admission.
Their admission will be regularized within a period of seven days after the date of the declaration of the result of the said semester.

O.M.D.10. Examination Schedule:

1. **Proposed Time of Examinations:** The examinations of the "Even Semester(s)" shall commence in the month of May in case of "Odd Semester(s)" it may commence in the month of December.

2. **Examination Application:** A candidate shall be required to apply on the prescribed '**Examination Application Form**' for the '**Semester End Examination**' to the Registrar/Dean/ Controller of Examinations through the Head of the concerned Department.
3. '**Examination Application Form**' must consist with following particulars and certificates signed by the appropriate authorities:
 - (a) Candidate has attended minimum number of lectures etc. in respect of all the Courses.
 - (b) Statement of '**No due Certificate**' with regard to all the dues including the fee due on all the heads.

O.M.D.11. Salient Features of the Choice Based Credit System:

1. PG Departments of the different Faculties of the University shall design the Semester based Choice Based Credit System (CBCS) for Master Degree programme. Students will be provided choice to select courses offered by the respective Department of the same faculty or any other Department of the same or any other Faculty, depending on his/her interest, needs and long term goals as well as the feasibility in terms of the available expertise and infrastructure at the Department level.
2. Each PG Department shall design and offer courses after the due consideration and approval of the **Departmental Staff Council (DSC)** and concerned authorities of the University.
3. **Composition of the DSC:** The DSC shall consist of all the regular faculty of concerned Department and the Head of the Department shall chair it. The DSC shall recommend to the Vice chancellor for approval the constitution of "**Credit Monitoring Committee (CMC)**", which consists of the Head of the Department and three senior most teachers of the

department. The Department having the faculty strength of less than three (including HOD) shall co-opt maximum up to two members of the rank of Professor of the same subject from other Universities with the permission of the Vice - Chancellor. The Vice chancellor shall have prerogative to drop, alter or substitute any name suo moto or on the further recommendation of the same. In the absence of the HOD, the DSC/CMC shall be chaired by the next senior faculty member of the concerned Department.

4. Registration of candidates in first and subsequent semesters after the last date will not be permitted. For subsequent semesters, no minimum credit earning criteria will be applicable. Credit registration at least once in all Compulsory Credit Course shall be binding. However, earning all CCC credits for accumulation of the prescribed minimum credits shall not be required.
5. A student shall be evaluated through CCA (Comprehensive Continuous Assessment) and Semester End Examination (SEE). The distribution of marks between the CCA and the Semester end examination shall be in the ratio of 30:70. Each paper/ Course shall consist of 100 marks. However; the Programme governed by the provisions of different Councils in case of inconsistency shall be exempted from this requirement.
6. The candidate will be required to finalize the number of credits at the time of the registration in the semester and no change will be permitted after seven days of the commencement of the semester. The CMC of the concerned Department will forward the credits registration detail of all the students enrolled in the semester. The prior approval of the CMC will be essential and its decision shall be final and binding.
7. Each course shall be assigned a specific number of credits.

8. The marks obtained by a student in a course shall be converted into Grade Points and Credit Points based on scale-normalized marks. The performance of a student in a Semester shall be expressed as Semester Grade Point Average (SGPA) and the combined performance of a student in all the semesters of the Master degree programme shall be expressed as Cumulative Grade Point Average (CGPA).
9. The Department is under obligation to arrange all Compulsory Core Courses and the special number of Elective Core Courses so that the students enrolled for the course can complete/obtain prescribed minimum number of credits. However, it will not be at all obligatory for the department to make provision for all the Elective Core Courses. Department can add, remove or substitute any course and course both in the Core and/ or Elective Course(s).
10. There will be no provision to conduct supplementary, due paper of special examination for any examination. Students with 'F' or 'E' Grade will be provided an option to re-register themselves in the said course subject to their desire as 'Self Study Course' or in a 'Regular Course' subject to the feasibility and availability of the resources in the department. The credit earned will not be considered in any case if the candidate has not re-registered and the same has not been approved by the CMC of the department at the time of the registration in the respective semester.

O.M.D.12. Credits: Weightage and Distribution:

1. The term 'Credit' refers to the weightage given to a course and means the unit by which the academic activity of course work is measured. In these Regulations, One Credit means one hour of Class Room Teaching per week in case of theory papers. For a theory course of 6 credits, 6 'contact hours' per week will be assigned in time-table and thus in a semester 90 contact hours will be assigned to a 5 credit course.

2. The minimum number of credits to be earned for a degree will be 30 times the number of semesters specified in the syllabus for the degree. For example for a two year four semester course the minimum numbers of credit to be earned will be 120. In case where a candidate earned more than the minimum number credits specified, the best credits upto minimum number of credits will be considered for CGPA. However, the total credits for different courses may be different subject to the nature and design of the course concerned and norms formulated by the regulatory authorities.
3. **Distribution of Credits:** Ordinarily, all semester shall have uniform distribution of credits.
4. **Credit Card:** Every department will be under an obligation to maintain academic credit card on the prescribed Performance developed and provided by the University Examination Department for students. The Credit card shall be issued to the students before the commencement of the next semester and a student will be under the obligation to attach the copy of the same with the application for registration as student in the next semester. The department will prepare two copies of the Credit Card one each for the student and for the office record of the department.

O.M.D.13. Assessment and Evaluation:

1. The CBCS is student centric not only in the teaching-learning processes but also in their evaluation process. In CBCS, the evaluation process is divided into two parts. The first part consists of Comprehensive Continuous Assessment (CCA) and the second part consists of the Semester End Examination. The division of marks between the two shall be as per the provisions of this ordinance in ratio 30:70. In the CBCS, the evaluation process shall follow the norm that the faculty, who teaches the course, shall conduct the

Comprehensive Continuous Assessment (CCA) and the Semester End Examination (SEE). The concerned faculty shall be accountable for transparency and reliability of the entire evaluation of the student in the concerned Course.

2. The comprehensive continuous assessment and evaluation (based on the performance of the student) process in CBCS is in continuous model is conducted for the purpose to bring periodically in to the notice of the candidate about his/her progress. The assessment is divided into four discrete components for reporting the scores to the student as earned by him/ her. The CMC shall announce policy for CCA for all the courses in the Department in the beginning of the Semester and the same shall be communicated to the students.
3. The details of the Comprehensive Continuous Assessment and Semester End Examination are summarized in the Table below:

Component	Unit covered in a Course/Paper	Mode of Evaluation	Weightage in Percentage	Marks	Period of Continuous Assessment
CCA-I	First 30%	Assignment/Field-Project Study/ Tour	10%	10	First part of the Semester. *Completed by the Fifth(5 th) Week.
CCA-II	Succeeding 30%	Seminar Presentation	10%	10	Second part of the semester. *Completed by the Tenth(10 th) Week.
CCA-III	Remaining 40%	Written/MCQ Test	10%	10	Third part of the Semester. *Completed by the Fifteenth(15 th) Week.
CCA-Sub Total			30%	30	
SEE	100%	Semester End Examination	70%	70	To be completed between 18 th - 20 th week of the Semester.

4. The marks/ grades awarded for the continuous assessment shall be notified to the students within a period of ten days from the date of the completion of the assessment. In case a student fails to secure 12 out of 30 in the CCA (all three components taken). He/she shall not be allowed to appear for the Semester End Examination.
5. Students may seek clarifications within period of a week from the date of the notification of the said result. No clarifications will be entertained after the expiry of the said period.
6. The Department will constitute a committee consists of three members and the Head will be the ex officio chairperson of the Committee to supervise the whole Examination Process.
7. The marks awarded by the teacher(s) are shall be kept confidential unless moderated and approved by the CMC/Dept. Examination committee constituted for the purpose. The Committee shall be under consideration to maintain the standards of the evaluation.

O.M.D.14. Semester End Examination:

1. Semester End Examination shall be conducted between 18th - 20th week of the semester.
2. The duration for per course shall be of three hours for theory courses and four hours for practical/laboratory courses, and half hour for seminar, project work or field study presentations.
3. Question papers for Semester End Examination shall be set keeping in mind to examine the candidates' creativity, comprehension, problem solving capacity, application side of the subject, interpretation and awareness capacities. It should not be expected from the students to reproduce the answers by memorizing the answers.

4. Paper Setting:

4.1.1. The question paper for the end-semester examinations for each course shall be set by the paper setter appointed for the purpose. It shall be the responsibility of the paper setter to ensure that the syllabus for the course is adequately covered in the question paper.

4.1.2. The questions may comprise; objective type, short notes, Descriptive or any other types as per the policy developed and designed by the department and approved by the competent academic authorities of the university and notified in advance. The University may retain the earlier pattern of setting papers which includes the requirement of 10/8 questions and students may be provided with choice to answer respectively 5/4 questions. The maximum marks of SEE shall be 70. All questions shall carry the marks mentioned in the paper.

4.1.3. The answer scripts for End-Semester Examinations shall be evaluated preferably, by the respective paper-setters, and or the mechanism developed by the university.

4.2.1. Appointment of paper-setter/examiner: The Boards of Studies in each subject shall draw a panel of paper-setters/examiners ordinarily in the month of August every alternate year and forward the same to the Academic Council which shall approve the panel of Paper-Setter/Examiner. While drawing the panel, the Chairman of the Board of Studies shall take into consideration the confidential aspect of the assignment.

The Vice chancellor if present preside the meeting of the Board but will not cast his vote. In his absence the Chairperson of the Board will preside the meeting.

However, the University may constitute group of teachers to set the paper through workshop method.

Provided further that the university may develop question bank with the help of examiners appointed subject to the provisions of this ordinance.

4.2.2. A person to be appointed as a Paper –Setter must be a full time teacher of the University/Colleges having at least 3 years Post Graduate teaching experience.

4.2.3. However, in exceptional circumstances, the Vice-Chancellor may relax the condition of experience and or alter or remove any paper setter.

4.3.1. Moderation Board and moderation of Question Papers:

There shall be a Moderation Board for each subject/programme of study and it shall consist of-

- a) Dean of the School concerned
- b) Head of the concerned Department,
- c) Two senior teachers nominated by the Head of the Department/ Departmental committee recommended by the Dean of school and finally approved by the Vice Chancellor.

4.3.2. The functions of the Board shall be:

- a) To ensure that the question paper has been set strictly in accordance with the syllabus and instructions given by the University covering broad areas adequately.
- b) To delete question(s) set from outside syllabus and to make necessary substitution, if required.
- c) To remove ambiguity in the language of question, if any,
- d) To moderate the questions properly giving ample opportunity to candidates of both average and exceptional capabilities,

- e) To ensure proper distribution and indication of marks for each question or part or parts thereof, time prescribed for the paper and to correct errors, if any, in this regard.
- f) To bring to the notice of the Controller of Examinations lapses or omission on the part of the Paper-Setter, if any.

4. Evaluation:

1. The CBCS is student centric scheme, not only in the teaching-learning processes but also in the evaluation process.
2. In CBCS, the evaluation process is divided into two parts. The first part consists of Comprehensive Continuous Assessment (CCA) and the second part consists of the Semester End Examination.
3. The division of marks between the two shall be as per the provisions of this Ordinance i.e. the CCA will have a weightage of 30 and SEE of 70 out of 100.
4. In the CBCS, the evaluation process shall follow the norm that the faculty, who teaches the course, shall conduct the Comprehensive Continuous Assessment (CCA) and the Semester End Examination (SEE) and the concerned faculty shall be accountable for transparency and reliability of the entire evaluation of the student in the concerned Course.
5. In Comprehensive Continuous assessment and Semester End Examination evaluation for each course shall be carried out on the basis of performance of students.
6. Continuous Assessment means 'internal assessment tests' or 'sessional tests' and end-on semester means theoretical or practical laboratory examinations along with

Project work/Field study/Educational Tour or preparation, dissertation or Term paper.

7. Each course shall carry credits as may be prescribed by Board of Studies time to time in the syllabus. The weightage assigned to 'Continuous Assessment' and 'Semester End Examination' shall be taken into the consideration for the purpose of determining the grade obtained by the student in a course,
8. Grade point shall be calculated for each course in 10 point scale system on the basis of total marks obtained in CC and SEE.
9. The Vice chancellor on the recommendation of Board of studies and approved by the Academic Council shall appoint Paper Setter-cum Examiner or constitute Board of Examiners for each course of study subject to the provisions of this Ordinance.
10. The Semester End Practical Examinations shall be jointly conducted by an external and an internal examiner.

O.M.D.15. Result Preparation:

1. The final result of the examination shall be prepared on the basis of 'comprehensive continuous assessment' and 'semester end examination' along with credits earned by the respective student.

The results after computation and tabulation shall be placed before the Vice Chancellor for approval after it has been moderated/scrutinized by a Board consisting of the Head of the concerned Department and not less than two faculty members appointed by the Dean.

2. Grade Assignments:

The grades in a course will be assigned on the basis of combined marks obtained in CCA and SEE. The total of maximum marks in CCA and SEE shall be 100 in all courses with a weightage of 30% to CCA. The letter grades and points will be assigned as per table given below.

Total Marks of CAA and SEE	Grade	Grade Definition	Grade Point
$90 < X \leq 100$	O	Outstanding	10
$80 < X \leq 90$	A	Excellent	9
$70 < X \leq 80$	B	Very good	8
$60 < X \leq 70$	C	Good	7
$50 < X \leq 60$	D	Fair	6
$39 < X \leq 50$	E	Average	5
Les than 40	F	Failed	0

3. Credit Point Assignments: Credit points earned in a course will be equal to product of Credit assigned to the course in the syllabus and grade point earned by the student on the basis of combined score in CAA and SEE.

4. Grade Card and /Mark sheet:

The University will issue the 'Grade Card' and "Mark Sheet" at the end of each semester to each student registered for the respective course from the examination. The Grade Card shall consist of at least the following particulars:

Basic Details: i. Name of the Student. ii. Father's Name. iii. Roll Number. iv. Enrolment / Registration / Unique Number.

Performance Details: For each course i. Course Code. ii. Course Title, iii Course type, iv. Credit of course, v. CAA marks, SEE Marks, Total Marks, Grade Point, Credit Point

Summary Performance Details: i. Total credit points earned in the semester, ii. Total credit earned in the semester, iii. SGPA, iv. Credit earned in Previous Semesters and v. CGPA (calculated till the end of current semester)

5. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) will be calculated on the credit weighted average of the grade points obtained as given below.

$$CGPA = \frac{\sum_{i=1}^n C_i P_i}{\sum_{i=1}^n C_i}$$

Where

C_i : Number of credits earned in the i^{th} course of Semester for which SGPA is to be calculated.

P_i : Grade Point Earned in i^{th} course

i : 1, 2, ..., n represents the number of courses in which a student is registered in the concerned semester.

$$SGPA = \frac{\sum_{i=1}^n C_i P_i}{\sum_{i=1}^n C_i}$$

Where

C_i : Number of credits earned in the i^{th} course of Course till date for which CGPA is to be calculated.

P_i : Grade Point Earned in i^{th} course

i : 1, 2, ..., n represents the number of courses in which a student is registered in the concerned semester.

6. The Cumulative Grade Point Average (CGPA) of all the courses after completing the programme or all semesters at the final stage of study shall be awarded in the Final Cumulative Grade Card. The Final Grade of the Master's degree programme will be assigned on the basis of Final CGPA as per table given below.

CGPA	Letter Grade	Classification
9.00 to 10.00	O	Outstanding
8.00 to 8.99	A	Excellent
7.00 to 7.99	B	Very good
5.50 to 6.99	C	Good
4.50 to 5.49	D	Fair
3.60 to 4.49	E	Average
O to 3.59	F	Failed

7. Equivalent Percentage of marks may be computed as ten times of CGPA. The candidates with CGPA equal to or higher than 5.5 (Letter Grade C) will be considered with good academic record and shall be treated as eligible wherever the minimum percentage of 55% is specified.
8. In case of LLM examination and other cases wherever specified specifically the candidates with CGPA less than 4.8 will be declared failed.

O.M.D.16. Promotion Rules:

- a) A candidate is eligible to continue the classes of next semester immediately after the examinations of one semester is over and he/ she can appear the next semester examination with any number of back/arrear papers.
- b) A candidate shall have to appear in 1st semester examinations to be eligible for promotion to 2nd semester. If and student could not appear or apply for 1st semester examination then he/she must have to take re-admission in 1st semester afresh.
- c) A candidate may get chance to clear the all courses double the duration of the course of study .i.e. for 2 year course within four years, for 3 year courses within 6 years, for 4 year courses within eight years and for 5 year courses within ten years.

O.M.D.17.: When a candidate at a 'University Semester End Examination' fails to obtain minimum marks for passing in a particular courses he/she will be required to reappear in that

course without keeping term for that semester. The candidate will have to reappear in the semester end examination by paying fresh examination fee along with an application form. Such candidate when obtains minimum or more than minimum marks for passing in the course, his/her actual marks of reappearance will be carried forward for award of class/CGPA.

O.M.D.18. RANKS:

First and Second Ranks will be awarded after completion of the course of study at the end of the final semester examination on the day of publication of final results.

On the basis of Average percentage of results as declared and on this basis of CGPA, Ranks will be awarded to the candidates in the subject.

O.M.D.19. General Guidelines:

- i) There will be no provision for repeat of betterment i.e. scope for re-appearing and paper again for obtaining better result.
- ii) If a candidate after admission in first semester could not continue the classes or could not obtain eligibility to get admission in first semester examination then he/she is to get re-admission in first semester again as fresh and he/she will not be allowed to continue study in other semester.
- iii) Candidates should be registered under Sant Gahira Guru within 3 months of study, if not obtained earlier. The conditions for obtaining Registration must be followed as specified in the Application form. Without Registration number of Sant Gahira Guru no students will be allowed to get admission in first semester examination or 2nd semester course of study.
- iv) The dates of commencement and termination of each semester shall be as fixed by the Academic Council.

) It will be obligatory for the Head of Department to take appropriate measures against Ragging & Gender problems arising in the University Department. In case of occurrence of any such incident, the violator shall be dealt with very seriously and appropriate stringent action be taken by the Head of Department by observing principle of natural justice. The Head of Department may appoint a committee to inquire in to the matter which will also observe the principle of natural justice. The committee will submit its report to the head of Department who will forward the, same with his comment there upon to the University Registrar, for taking further necessary action in the matter.

Candidates must forward their applications for admission to University examination to the registrar on or before the prescribed date with a certificate of attendance duly signed by the Head of the Department along with the examination fees fixed by the University.

Thirty percent internal evaluation shall be within the exclusive purview of the concerned Head of Department which requires purity, transparency accuracy in the evaluation & assessment of students. The benefits of re-assessment scheme will not be made available to the students as regards the internal assessment.

) There will be theory and practical examination if prescribed in the syllabus, at the end of the fourth semester. The viva voce examination will be conducted at the end of the fourth semester.

Subject to the provisions of University Act., Statutes, Ordinances, Rules and Regulations, the University will prepare, design and enact syllabus/prospectus for different Master Degree programmes under the different faculties time to time.

O.M.D.20.: EMPOWERING CLAUSE: Subject to the provisions of this ordinance, the University shall run Master Degree programme(s) prepared and approved by the Academic authorities of the University including the Board of Studies and Faculty of the respective subject and approved by the Academic Council and the Executive Council.

Semester Structure Table

Appendix

Note: The Department Staff Council may subject to the approval of the Board of Studies of the respective subject, respective Faculty and the Academy Council of the University, may way of addition or deletion introduction of new or additional subject or amend the given scheme including the increase the number of papers under the same code number or inserting additional or new code numbers.

Provided further that the University may design different CBC scheme for the different Master Degree programme depending on their nature, scope & requisites. In such situation, the scheme will be notified with semester wise detail evaluation scheme and the syllabus of the respective subject/course.

Thus the actual semester structure table may vary for the different master degree programme. The one given below is for an example.

ABC: In tables given below ABC shall be replaced by Three Letter Subject Code of the degree programme for example PH for M.Sc. Physics.

The table assumes that six clusters A, B, C, D, E, F are available for Elective Core Courses each involving four courses labeled like A01, A02, A03, A04.

The Interdisciplinary courses are classified under OSC

First Semester Structure Table

S. No.	Subject Code	Course Title	Course Type	Credit	Contact Hours Per week			EoSE Duration (Hrs.)	
					L	T	P	Thy	P
1.	ABC 101		CCC	6	4	2	0	3	0
2.	ABC 102		CCC	6	4	2	0	3	0
3.	ABC 103		CCC	6	4	2	0	3	0
4.	ABC S01	Other Supportive Course	OSC	6	4	2	0	3	0
5.	ABC A01/B01/ C01/D01/ E01/F01		ECC	6	4	2	0	3	0
				30					

Second Semester Structure Table

S. No.	Subject Code	Course Title	Course Type	Credit	Contact Hours Per week			EoSE Duration (Hrs.)	
					L	T	P	Thy	P
1.	ABC 201		CCC	6	4	2	0	3	0
2.	ABC 202		CCC	6	4	2	0	3	0
3.	ABC 203		CCC	6	4	2	0	3	0
4.	ABC 221		PRJ/FST/ EST	6	4	2	0	3	0
5.	ABC A02/B02/ C02/D02/ E02/F021		ECC	6	4	2	0	3	0
				30					

Third Semester Structure Table

S. No.	Subject Code	Course Title	Course Type	Credit	Contact Hours Per week			EoSE Duration (Hrs.)	
					L	T	P	Thy	P
1.	ABC 301		CCC	6	4	2	0	3	0
2.	ABC 302		CCC	6	4	2	0	3	0
3.	ABC 303		CCC	6	4	2	0	3	0
4.	ABC S02		OSC	6	4	2	0	3	0
5.	ABC A03/B03/ C03/D03/ E03/F03		ECC	6	4	2	0	3	0
				30					

Fourth Semester Structure Table

S. No.	Subject Code	Course Title	Course Type	Credit	Contact Hours Per week			EoSE Duration (Hrs.)	
					L	T	P	Thy	P
1.	ABC 401		CCC	6	4	2	0	3	0
2.	ABC 402		CCC	6	4	2	0	3	0
3.	ABC 403		CCC	6	4	2	0	3	0
4.	ABC 421		PRJ/FST/ EST	6	4	2	0	3	0
5.	ABC A04/B04/ C04/D04/ E04/F04		ECC	6	4	2	0	3	0
				30					

Bachelor Degree in any Science (Pure & Bioscience)	MBT101	CCC	CELL AND MOLECULAR BIOLOGY	5	4	2	0	3	0
1) Merit List 2) Entrance Test (written or/and oral) if decided by the University 3)	MBT111	CCC	CELL AND MOLECULAR BIOLOGY (PRACTICAL)	2	00	00	3	0	3
	MBT102	CCC	GENETICS AND CYTOGENETICS	5	4	2	0	3	0
	MBT112	CCC	GENETICS AND CYTOGENETICS (PRACTICAL)	2	00	00	3	0	3
	MBT103	CCC	PHYSIOLOGY AND BIOCHEMISTRY	5	4	2	0	3	0
Observance of Reservation Policy.	MBT113	CCC	PHYSIOLOGY AND BIOCHEMISTRY (PRACTICAL)	2	00	00	3	0	3
	MBT S01	OSC	RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASICS	6	4	3	00	3	00
	MBT A01	ECC/CB	CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM.	6	4	3	00	3	00
	MBT A02	ECC/CB	RECOMBINANT DNA TECHNOLOGY AND PROTEOMICS	6	4	3	00	3	00

TOTAL=
33

M.Sc (BOTANY)		1ST SEMESTER	
COURSE CODE: MBT101		COURSE TYPE: CCC	
COURSE TITLE: CELL AND MOLECULAR BIOLOGY			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1- 18 Hours	Introduction to modern tools and techniques of cell biology: advances in light and electron microscopy, techniques supplementing microscopy (cytochemistry, microprobe analysis, x-ray diffraction, etc.), Cell fractionation and visualization/characterization of various cell fractions.		
UNIT-2- 18Hours	Cell components and their functions : Dynamic structure, functions and biogenesis of cell wall and plasma membrane; new insights in structure and function of cytoplasmic cell organelles and biopolymers; nucleus; its components, chromatin structure in eukaryotes, condensation and packaging of DNA in prokaryotes, their dynamic state and role in gene regulation; structure and function of plant cytoskeletal genes and gene products; protein sorting and intracellular trafficking.		
UNIT-3- 18 Hours	Cell multiplication and turnover: Cell cycle, Cell division and apoptosis,		
UNIT-4- 18Hours	Gene structure, regulation and expression in eukaryotes : Gene and promoter architecture, cistrons, regulatory sequences, enhancers and their mechanism of action, DNA replication; transcription - RNA polymerases, transcription factors, Introns, RNA splicing, alternative splicing, RNA stability - cap structure and function, polyadenylation; translation, posttranslational modifications.		
UNIT-5- 18Hours	Organellar genomes : Organization and function of mitochondrial and chloroplast genomes, diversity and evolution of organelle genomes, chloroplast protein targeting to different compartments, mitochondrial DNA and male sterility, transfer of genes between nucleus and organelles.		

1. To exemplify the use of phase contrast and fluorescence microscopy in plant biology by studying phase objects and auto fluorescent specimens or those stained with Fluoro chromes, such as, carbo fluorescein diacetate, aniline blue, calcofluor white, Evans blue and neutral red.
2. Isolation and purification of nuclei and their staining with Feulgen stain or DAPI.
3. Isolation of mitochondria and their visualization with Janus green B and mitotracker.
4. Isolation of chloroplasts and determination of number of chlorophyll molecules per chloroplast.
5. Comparing the effect of some physical and chemical factors on the efficiency of photosynthetic electron transport.
6. To study the effect of inhibitors and uncouplers on the activity of succinic dehydrogenase, a marker enzyme of mitochondria.
7. Molecular characterization of GUS-actin constructs in *Arabidopsis thaliana* using microscopy and PCR.
8. Immuno staining of nuclei, chloroplast and/or mitochondria.

1. Alberts B, Johnson A, Lewis J, Raff Martin, Roberts K and Walter P. (2007) *Molecular Biology of the Cell*. Garland Publ., New York.
2. Bonifacino JS, Dasso M, Harford JB, Liipincott-Schwartz J and Yamada KM. (2004) *Short Protocols in Cell Biology*. John Wiley & Sons, New Jersey.
3. Bregman AA (1987) *Laboratory Investigations in Cell Biology*. John Wiley & Sons, New York.
4. Hawes C and Satiat-Jeunemaitre B (2001) *Plant Cell Biology: Practical Approach*. Oxford University Press, Oxford.
5. Hirt RP and Homer DS (2004) *Organelles, Genomes and Eukaryote Phylogeny: Aevolutionary synthesis in the age of genomics*. CRC Press.
6. Karp G. (2008) *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.
7. Lodisch H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H and Matsudaire P (2008) *Molecular Cell Biology*. WH Freeman & Co., New York.
8. Ruzin SE (1999) *Plant Microtechnique and Microscopy*. Oxford Univ. Press, Oxford.
9. Wischnitzer S. (1989) *Introduction to Electron Microscopy*. Pergamon Press, New York.

M.Sc (BOTANY)		1ST SEMESTER	
COURSE CODE: MBT102 COURSE TYPE: CCC			
COURSE TITLE: GENETICS AND CYTOGENETICS			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	
OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1- 18 Hours	<p>Microbial Genetics: Viral and bacterial genomes and derived vectors; Recombination in viruses and bacteria (transformation, conjugation and transduction); Fine structure of gene; Prokaryotic gene regulation; Fungal genetics – mating types and genetic exchange, heterokaryosis, parasexual cycle.</p> <p>Mendelian and Non-Mendelian Inheritance: Chromosome theory of inheritance; Mendelian laws; Gene interactions; Organelle inheritance.</p>		
UNIT-2- 18Hours	<p>Eukaryotic Genome : Evolution, structure and organization; Gene regulation. Recombination in Eukaryotes: Linkage and crossing over: basic concepts, linkage maps, correlation of genetic and physical maps, molecular markers and construction of linkage maps; Molecular mechanism of recombination; QTL mapping.</p>		
UNIT-3- 18 Hours	<p>Mutation: Basic concept, spontaneous and induced mutations, allele theory, physical and chemical mutagens; Molecular basis of mutations; Transposons and their use in mutagenesis and gene tagging in plant systems; Oncogenes and cancer.</p>		
UNIT-4- 18Hours	<p>Concepts in: Developmental genetics; Behavioral genetics; Population genetics and Quantitative genetics.</p>		
UNIT-5- 15Hours	<p>Cytogenetics: Chromosome : Structure and nomenclature, centromere and telomere; Sex determination: mechanisms, sex chromosomes; Chromosomal aberrations: Duplications, deficiencies/deletions, inversions, interchanges/translocations; Role of chromosomal aberrations in crop evolution. Ploidy changes: Haploids, polyploids and aneuploids; Genome analysis in crop plants. Molecular Cytogenetics: FISH, GISH, FIBER-FISH, Flow Cytogenetics, Flow karyotyping, Applications of molecular cytogenetics</p>		

**LABORATORY
WORK
(MBT112)**

- Preparation of mitotic and meiotic spreads and analysis of various stages of cell division (Phlox, Allium and Rhoeo).
2. Extraction of genomic DNA from plants by CTAB method.
 3. Analysis of molecular polymorphism in parental lines and derived mapping population using different types of molecular markers.
 4. Construction of a linkage map using available data.
 5. Mutagenesis experiments in *E. coli*.
 6. Experiments in *Neurospora*/*Drosophila* genetics.

**SUGGESTED
READINGS**

- Acquaah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.
2. Allard RW (1999). Principles of Plant Breeding (2nd Edition), John Wiley and Sons.
 3. Hartl DL and Jones EW (2007). Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers.
 4. Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC (2006). Genetics – From Genes to Genomes, 3rd edition, McGraw Hill.
 5. Lewin B (2008). Genes IX, Jones and Barlett Publishers.
 6. Singh RJ (2002). Plant Cytogenetics, 2nd edition, CRC Press.
 7. Smartt J and Simmonds NW (1995). Evolution of Crop Plants (2nd Edition) Longman.
 8. Strickberger MW (2008). Genetics, 3rd Edition, Pearson (Prentice Hall).
 9. Weising K, Nybom H, Wolff K and Kahl G (2005) DNA Fingerprinting in Plants: Principles, Methods and Applications, 2nd ed. Taylor and Francis Group, Boca Raton, FL.

M.Sc (BOTANY)		IST SEMESTER	
COURSE CODE: MBT103		COURSE TYPE: CCC	
COURSE TITLE: PHYSIOLOGY AND BIOCHEMISTRY			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:34	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of			
UNIT-1- 18 Hours	<p>Protein structure : Hierarchical structure of proteins; folding; ticketing; degradation; purification, detection and functional characterization; sequence alignments; molecular motors and pumps.</p> <p>Enzymes and bioenergetics: Application of principles of thermodynamics in biology; origin and evolution of biocatalytic reactions; significance of ribozymes; abzymes; artificial enzymes; enzyme technology; regulation of enzymatic activity; evolution of electron transport chain and its coupling to ATP synthesis; bioelectricity, photosynthesis and respiration.</p>		
UNIT-2- 18Hours	<p>Signal Transduction : Overview, second messengers, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanisms and their regulation, e.g. simple and hybrid type of two-component sensor-regulator system in bacteria and plants (examples of chemotaxis, osmosensing, ethylene and cytokinin signaling), quorum sensing.</p>		
UNIT-3- 18Hours	<p>Sensory Photobiology : Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; scotomorphogenesis and photomorphogenesis. Plant Movements & Stress Physiology.</p>		
UNIT-4 18Hours	<p>Plant hormones and other growth regulators : Concept of hormones as chemical messengers, techniques for detection and quantitation of plant hormone, classical approaches and use of mutants in understanding hormone actions, hormones in defense against abiotic and biotic stresses, synthetic regulatory compounds and their uses.</p>		
UNIT-5 15Hours	<p>Physiology of plant reproduction : Reproductive strategies in higher plants and their significance. Sexual and non-sexual modes. Flowering as a multi-organ function, floral induction, evocation and development. Regulation of flowering by light and temperature. Role of circadian rhythm. Involvement of hormones. Genetic, molecular and biotechnological aspects. Manipulation of flowering and floriculture. Vegetative propagation with special reference to epiphyllous budding.</p>		

- In vivo assay for nitrate reductase in leaf tissues.
2. Comparative assessment of methods for protein quantitation.
 3. Study of enzyme kinetics for determination of K_m value, nature of inhibition – competitive/non competitive.
 4. Study of enzyme kinetics for effect of time/ enzyme concentration/ pH.
 5. Extraction of proteins from plant tissue and their quantitative (Bradford's) and qualitative (SDS, PAGE gel) analysis.
 6. Detection of phosphoproteins in plant (Brassica) extract by pro Q diamond staining.
 7. Qualitative and quantitative analysis of photosynthetic pigments and anthocyanins by spectrophotometric and chromatographic techniques.
 8. PAGE analysis of pigment-protein complexes from chloroplasts.

- Ainsworth C (2006) Flowering and its Manipulation, Annual Plant Reviews, Vol. 20. Blackwell Publishing, Oxford, U.K.
2. Brown TA. (2002) Genomes, BIOS Scientific Publishers Ltd, Oxford, UK.
 3. Buchanan B, Gruissem G and Jones R. (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA.
 4. Davies P J. (2004) Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands.
 5. Jordan BR. (2006) The Molecular Biology and Biotechnology of Flowering, 2nd Edition, CAB International, Oxfordshire, U.K.
 6. Lodish H, Berk A, Kaiser CA and Krieger M. (2008) Molecular Cell Biology, 6th Edition, W.H. Freeman and Company, New York, USA.
 7. Nelson DL and Cox MM. (2004) Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.
 8. Taiz L and Zeiger E. (2006) Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA.

M.Sc (BOTANY)		1ST SEMESTER
COURSE CODE: MBTS 01		COURSE TYPE: O3C
COURSE TITLE RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASIC		
CREDIT : 06	HOURS : 90	
THEORY : 06	THEORY : 90	
MARKS : 100		
THEORY: 80	CCA : 20	
OBJECTIVE : <ul style="list-style-type: none"> - Understands the concept and place of research in concerned subject - Gets acquainted with various resources for research - Becomes familiar with various tools of research - Gets conversant with sampling techniques, methods of research and techniques of analysis of data - Achieves skills in various research writings - Gets acquainted with computer Fundamentals and Office Software Package . 		
UNIT-1 15 Hours	CONCEPT OF RESEARCH : Meaning and characteristics of research ; Steps in research process , Types of research i) Basic, applied and action research ii) Quantitative and qualitative research , Area research in concern discipline SELECTION OF PROBLEM FOR RESEARCH : Sources of the selection of the problem , Criteria of the selection of the problem , Draft research proposal , Meaning and types of variables , Meaning and types of hypotheses	
UNIT-2 15 Hours	TOOLS OF RESEARCH : Meaning and general information about construction procedure of (i) Questionnaire Interview, (iii) Psychological test, (iv) observation (v) Rating scale (vi) Attitude scale (vii) check list , Advantages and disadvantages of above tools SAMPLING : Meaning of population and sample , Importance and characteristics of sample , Sampling techniques - i) Probability sampling : random sampling, stratified random sampling, systematic sampling, cluster sampling ii) Non-probability sampling: incidental sampling, purposive sampling, quota sampling	
UNIT-3 15 Hours	METHODS OF RESEARCH Meaning and conducting procedure of following methods of research ; Historical method Survey method, Case study, Causal comparative method , Developmental methods Experimental methods	
UNIT-4 15 Hours	TREATMENT OF DATA : Level of measurements of data , Steps in treatment of data: editing, coding, classification, tabulation, analysis and interpretation of results WRITING RESEARCH REPORT : Sections of report : Preliminary section , Content section : various chapters, Supplementary section : appendices, references, abstract , Format and style	

UNIT-5
15 Hours

Computer Fundamentals

Computer System : Features, Basic Applications of Computer, Generations of computers.

Parts of Computer System : Block Diagram of Computer System ; Central Processing Unit (CPU) ; Concepts and types of Hardware and Software, Input Devices - Mouse, Keyboard, Scanner, Bar Code Reader, track ball ; Output Devices - Monitor, Printer, Plotter, Speaker ; Computer Memory - primary and secondary memory, magnetic and optical storage devices.

Operating Systems - MS Windows : Basics of Windows OS ; Components of Windows - Icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders ;

Control panel : display properties, adding and removing software and hardware, setting date and time, screensaver and appearance ;

Windows Accessories : Calculator, Notepad, WordPad, Paint Brush, Command Prompt, Windows Explorer.

UNIT-6
15 Hours

Office Software Package

Word Processing - MS Word : Creating, Saving, Opening, Editing, Formatting, Page Setup and printing Documents ; Using tables, pictures, and charts in Documents ; Using Mail Merge sending a document to a group of people and creating form, letters and label.

Spreadsheet - MS Excel : Opening a Blank or New Workbook, entering data/Function/ Formula into worksheet cell, Saving, Editing, Formatting, Page Setup and printing Workbooks.

Presentation Software - MS Power Point : Creating and enhancing a presentation, modifying a presentation, working with visual elements, adding Animations & Transitions and delivering a presentation.

SUGGESTED READINGS

Agrawal, Y. P. (1988). *Better sampling : Concepts, Techniques and Evaluation*. New Delhi : Sterling Publishers Private Ltd. Best, J. W. (1993).

Research in Education (6th ed.) New Delhi : Prentice-Hall of India Pvt. Ltd. Broota, K. D. (1992) *Experimental design in Behavioral Research* (2nd ed.)

New Delhi : Wiley Eastern Limited.

Dasgupta, A. K. (1968). *Methodology of Economic Research*. Bombay: Asia Publishing House.

Edwards, A. L. (1957). *Techniques of Attitude Scale construction*. New York: Appleton-Century

Gall, M. D., Gall, J. P. and Borg, W. R. (2007). *Educational Research : An introduction* (8th ed.) Coston : Allyn and Bacon.

Garrett, H. E. & Woodworth, R. S. (1969). *Statistics in Psychology and Education*. Bombay : Vakils, Fecffer & Simons Pvt. Ltd.

Goode, W. J. & Hatt, Paul K. (1952). *Methods in Social Research*. New York : McGraw-Hill.

Gopal, M. H. (1964). *An Introduction to research Procedure in Social Sciences*. Bombay : Asia

Publishing House.

Hillway, T. (1964) *Introduction to Research* (2nd ed.) Noston : Houghton Mifflin.

Hyman, H. H., et al. (1975). *Interviewing in Social Research*.

Chicago : University of Chicago Press.

Kerlinger, F. N. (1983) *Foundation of Behavioural Research*. (2nd Indian Reprint)

New York : Holt, Rinehart and Winston.

Kothari, C. R. (2007) *Research Methodology: Methods & Techniques* (3rd ed.)

New Delhi : Wishwa Prakashan. *Fundamentals Of Computers*, Dr. P. Mohan, Himalaya Publishing House.

Microsoft First Look Office 2010, K. Murray, Microsoft Press.

Fundamental Of Research Methodology And Statistics, Y.K. Singh, New Age

International (P) Limited, Publishers. *Practical Research Methods*, Dr Catherine Dawson,

The Essence Of Research Methodology, Jan Jonker & Bartjan Pennink, Springer.

COURSE TITLE: CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM

CREDIT: 06	HOURS: 90
THEORY: 06	THEORY: 90

MARKS: 100
THEORY: 80 **CCA:** 20

- OBJECTIVE:**
- Understands the concept of Constitutionalism
 - Gets acquainted with various Indian Political System
 - Becomes familiar with various Union Executive
 - Gets conversant with Legislatures, Legislative Bills
 - Achieves skills in various writings

UNIT - 1
12 Hrs
 Meaning: Constitution, Constitutional government & constitutionalism; Difference between Constitution & Constitutionalism; Constitutionalism: Basis, Elements, Features & future Forms of Government: Democracy & Dictatorship, Unitary & Federal, Parliamentary & Presidential form. Ideals of the Indian Constitution incorporated in the Preamble. Special Features of the Indian Constitution.

UNIT - 2
24 Hrs
 Concept of State and Citizenship, Judicial Review and Fundamental Rights, Directive Principles of the State Policy, Fundamental Duties, Procedure to Amend the Indian Constitution, Judiciary: Supreme Court and High Court, Judicial Activism and Public Interest Litigation and Provisions relating to Emergency.

UNIT - 3
10 Hrs
 Union Executive- President, Prime Minister, Council of Ministers. State Executive Governor, Chief Minister and Council of Ministers. Local Bodies & Panchayati Raj

UNIT - 4
24 Hrs
 Parliament of India, State Legislatures, Legislative Bills: Ordinary, Money and Financial Union State Relations, Principles of the „Separation of Power and the „Principles of Check & Balance“. Political Parties and Pressure Groups. Challenges before Indian Democracy: Terrorism, Regionalism, Communalism, Linguistics and National Integration.

UNIT - 5
20 Hrs
 Controller & Accountant General of India, Solicitor General, Advocate General, Election Commission, Union and State(s) Public Service Commission, Finance Commission.

- HOBBS, Thomas, The Leviathan, Chapters XIII & XVII [entry]
LOCKE, John, The Second Treatise of Civil Government, Chapter IX [entry]
ROUSSEAU, Jean-Jacques, The Social Contract or Principles of Political Right
MONTESQUIEU, The spirit of the laws,
RAZ, Joseph, "The rule of law and its virtue", in The authority of law, Oxford University Press, 1979
Dicey on British constitution
P. Ishwara Bhat Inter-relationship between Fundamental Rights
MP Jain Indian Constitutional Law
HM Seervai Constitutional Law of India
VN Shukla Constitution of India
DDBasu Shorter Constitution of India
B Sivarao Constitutional Assembly Debates
J. V R Krishna Iyer Fundamental Rights and Directive Principles
Paras Diwan Human Rights and the Law
PK Tripathi Some Insight into Fundamental Rights
SP Sathe Fundamental Rights and Amendment to the Constitution
PB Gajendragadkar Law, Liberty and Social Justice
David Karrys Politics of Law

M.Sc (BOTANY)		1ST SEMESTER	
COURSE CODE: MBTA02		COURSE TYPE: ECC	
COURSE TITLE: RECOMBINANT DNA TECHNOLOGY AND PROTEOMICS			
CREDIT: 0		HOURS: 90	
THEORY: 0	PRACTICAL: 0	THEORY: 90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL: 00	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

UNIT-1
18 Hours
Principles and tools of recombinant DNA technology : Restriction and nucleic acid modifying enzymes; restriction mapping;

UNIT-2
18Hours
Principles of gel electrophoresis; choice of vectors; plasmids, phages, cosmids, plant viruses, synthetic DNA vectors;

UNIT-3
18 Hours
DNA and genomic libraries; Isolation of specific genes from bacteria and higher plants; cloning; PCR and its applications; Principles of DNA sequencing.

UNIT-4
18Hours
Proteomics : Comparative account of translation in prokaryotes and eukaryotes, post translational modifications, Use of vectors for over-expression of proteins, Protein extraction/purification techniques viz.,

UNIT-5
18Hours
Electrophoresis and column chromatography, Introduction to proteome and proteomics and its relevance/significance in the post genomic era, Proteomics as a tool for plant genetics, breeding and diversity studies.

SUGGESTED READINGS

1. Buchanan B, Grissem G and Jones R (2000). Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA.
2. Harlow and Lane D (Eds.) (1988). Antibodies – A Laboratory Manual; Cold Spring Harbor Laboratory, USA.
3. Lieber DC (2006). Introduction to Proteomics: Tools for New Biology; Humana Press, NJ.
4. Pennington SR, Dunn MJ (Eds.) (2002). Proteomics: From Protein Sequence to Function, BIOS Scientific Publishers, United Kingdom.
5. Sambrook J and Russell DW (2001). Molecular Cloning – A Laboratory Manual, Vols I–III, Cold Spring Harbor Laboratory, USA.
6. Singer M and Berg P (1991). Genes and Genomes: A Changing Perspective; University Science Books, CA, USA.

M. Sc. in BOTANY
 • SECOND SEMESTER (EVEN SEMESTER)

Eligibility Criteria (Qualifying Exams)	Course Code	Course Type	Course (Paper/Subjects)	Credits			Contact Hours Per Week			EoSE Duration (Hrs.)		
				L	T	P	L	T	P	Thy	P	
After appearing in the First semester examination in any number of back arrears papers	MBT201	CCC	DEVELOPMENTAL BIOLOGY	5			4	2	00	3	00	
	MBT211	CCC	DEVELOPMENTAL BIOLOGY (PRACTICAL)	2			00	00	3	00	3	
	MBT202	CCC	PATHOGENS AND PESTS OF CROP PLANTS	5			4	2	00	3	0	
	MBT212	CCC	PATHOGENS AND PESTS OF CROP PLANTS (PRACTICAL)	2			00	00	3	00	3	
	MBT203	CCC	PLANT BIOTECHNOLOGY AND RESOURCE UTILIZATION	5			4	2	00	3	0	
	MBT213	CCC	PLANT BIOTECHNOLOGY AND RESOURCE UTILIZATION (PRACTICAL)	2			00	00	3	00	3	
	MBT 221	PRJ/FS/TEST	SOCIAL OUTREACH AND SKILL DEVELOPMENT	6			00	00	9	00	4	
	MBT B01	ECC/CB	ENVIRONMENTAL AND FOREST LAWS	6			4	3	00	3	00	
	MBT B02	ECC/CB	SYSTEMATICS, EVOLUTION AND ENVIRONMENTAL SCIENCE									
				TOTAL=	33							

M.Sc (BOTANY)		IIND SEMESTER	
COURSE CODE: MBT201		COURSE TYPE: CCC	
COURSE TITLE: DEVELOPMENTAL BIOLOGY			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

Archegoniatae : Comparative morphology and developmental anatomy of Hepaticae, Anthocerotae and Musci; comparative anatomy of vegetative organs of Pteridophytes; study of stem apex, leaf initiation and early leaf ontogeny in ferns; development of long and short shoots, origin and pattern of development of cortex, pith and procambium in conifers.

UNIT-2
18Hours

Vascular plants : Meristems; patterns of cell fate, determination and lineage in root and shoot; leaf growth and differentiation; secondary growth; wood development and its diversity; cambial variants; ultrastructure and control of xylem and phloem differentiation; secretory ducts and laticifers; flower, seed and fruit anatomy; patterns of evolution in seed; anatomical adaptations for special habitats, biotic and abiotic stresses; Applications (in brief) of anatomical studies in systematics, archaeology, climate studies, pharmacology, forensic sciences and biomedical research.

UNIT-3
18 Hours

Development of flower : Transition to flowering - vegetative to reproductive evocation; floral homeotic mutations in Arabidopsis, Antirrhinum and Petunia, axis development in flower, gender expression in monoecious and dioecious plants.
Developmental biology of male and female gametophytes: Regulation of anther and ovule development, microsporogenesis and microgametogenesis, megasporogenesis and megagametogenesis, male sterility- mechanisms and applications, pollen embryogenesis

UNIT-4
18Hours

Pollen-pistil interaction : In vivo and in vitro pollen germination, pollen tube growth and guidance, double fertilization, self-compatibility mechanisms, incongruity

UNIT-5
18Hours

Embryogenesis and seed development : Polarity during embryogenesis, pattern mutants, in vitro fertilization, endosperm development, apomixis, polyembryony, somatic embryogenesis.

LABORATORY
WORK
(MBT211)

1. Study of morphology and anatomy of thalloid and leafy forms of Bryophytes; Study of Protonema
2. Study of fern gametophyte and soral variations
3. Comparative anatomy of conifers and gnetales.
4. Study of apical meristems with the help of dissections, whole mount preparations, sections and permanent slides.
5. Origin and development of epidermal structures (trichomes, glands and lenticels).
6. Study of xylem and phloem elements using maceration, staining, light and electron micrographs (xerophytes, hydrophytes and halophytes).
7. Study of secretory structures (nectaries and laticifers).
8. Study of secondary growth (normal and unusual) of selected woods with the help of wood microtome and permanent slides.
9. Study of the stages of pollen and ovule development in the wild and mutant plants using permanent slides, electron micrograph and available phenotypes.
10. Pollen in vitro germination methods: Sitting drop culture, suspension culture, surface culture.
11. Correlation between fertility (stainability), viability (TTC and FDA staining) and germinability (in vitro) of pollen grains.
12. Assessment of stigma receptivity by localizing peroxidases, non-specific esterases and phosphatases.
13. Aniline blue fluorescence method to localize pollen tubes to study different aspects of pollen-pistil interaction.
14. Use of DNA fluorochromes to localize nuclei during pollen and ovule development.
15. Study of post-fertilization stage with the help of permanent slides and electron micrographs.
16. Dissection of embryo and endosperm.

SUGGESTED
READING
GS

1. Anderson RA (2005) Algal Culturing Techniques. Physiological Society of America. Elsevier Academic Press, USA.
2. Bhatnagar SP and Moitra A (2005) Gymnosperms. New Age Interactive (P) Ltd. Publishers, New Delhi.
3. Carlquist S (2001). Comparative Wood Anatomy, Springer-Verlag, Germany.
5. Cutler DF (1978). Applied Plant Anatomy, Longman, United Kingdom
6. Cutter EG (1978) Plant Anatomy, Part I & II, Edward Arnold, United Kingdom.
7. Dickinson WC (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA.
8. Fahn A (1974) Plant Anatomy, Pergamon Press, USA & UK.
9. Fosket DE. (1994) Plant, Growth and Development: A Molecular Approach, Academic Press.
10. Fritsch FE (1935, 1945). The Structure and Reproduction of Algae Vols. I and II. Cambridge University Press, Cambridge, UK.
11. Hopkins WG. (2006). The Green World: Plant Development, Chelsea House Publication
12. Howell SH. (1998) Molecular Genetics of Plant Development, Cambridge University Press.
13. Leyser O and Day S (2003) Mechanism of Plant Development, Blackwell Press
14. Mauseth JD (1988). Plant Anatomy, The Benjamin/Cummings Publisher, USA
15. Nair MNB (1998). Wood Anatomy and Major Uses of Wood, Faculty of Forestry, University of Putra Malaysia, Malaysia.
16. Parihar NS (1993) An Introduction to Embryophyta: Vol I – Bryophyta, Vol II – Pteridophyta, Central Book Dept. Allahabad.
17. Raghavan V (2000) Developmental Biology of Flowering Plants, Springer, Netherlands
18. Raghavan V (1997). Molecular Embryology of Flowering Plants. Cambridge University Press.
19. Richards AJ (1986) Plant Breeding System, George Allen and Unwin.
20. Shivanna KR (2003) Pollen Biology and Biotechnology, Science Publishers.

M.Sc (BOTANY)		II nd SEMESTER	
COURSE CODE: MBT202 COURSE TYPE: CCC			
COURSE TITLE: PATHOGENS AND PESTS OF CROP PLANTS			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1 18 Hours	General characteristics of pests including viruses, - Life cycles - Nature of disease(s) and damage caused.		
UNIT-2 18Hours	Case studies of economically important causative agents with specific references to crop plants: - Plant-virus interactions with emphasis on potyviruses and horticultural crops.		
UNIT-3 18 Hours	Bacteria, fungi, insects and nematodes with reference to the following: Host range - Control mechanisms based on genetics, chemical treatments, biological control and genetic engineering		
UNIT-4 18Hours	Plant-bacterial interactions with emphasis on Erwiniasp. and potatoes. - Plant-fungus interactions with emphasis on Magnaporthesp. and rice. - Plant-nematode interactions with emphasis on Meloidogynesp. and tomato. - Plant-Insect interactions with emphasis on Pierissp. and crucifers		
UNIT-5 18Hours	Plant pathogenic micro organisms Phanerogamic parasites. Abiotic or non pathogenic disease. Methods of studying plant disease.		

**LABORATORY
WORK
(MBT)**

1. Methods of sterilization; Media preparation (selective media); Inoculation procedures.
2. Characterization of disease symptoms and identification of pathogenic organisms.
3. A study on effects of various formulation and doses of BTK on growth and development of selected pest species.
4. Isolation and identification of rhizosphere soil fungi, seed borne fungi
5. Isolation and estimation of DNA from fungus
6. Biochemical markers of enhanced resistance
 - (i) Estimation of total phenols and O-di hydroxy phenols in sugarcane and groundnut
 - (ii) Estimation of activity of Phenylalanine ammonia lyase in healthy and diseased leaves of sugarcane
 - (iii) Estimation of deoxyribonuclease and ribonuclease enzymes produced by virus infected and healthy leaves of tobacco
7. Research paper discussions.

**SUGGESTED
READING
S**

1. Agrios GN (2005) Plant Pathology, 5th Edition.
2. Buchanan B, Gruissem G and Jones R (2000) Biochemistry and Molecular Biology of Plants", American Society of Plant Physiologists, USA.

M.Sc (BOTANY)		II nd SEMESTER	
COURSE CODE: MBT203		COURSE TYPE: CCC	
COURSE TITLE: PLANT BIOTECHNOLOGY AND RESOURCE UTILIZATION			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:34	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/Plant Science.

**UNIT-1-
18 Hours** Plant tissue culture : History, concepts of cell differentiation and totipotency; pathways for in vitro regeneration: organogenesis, somatic and gametic embryogenesis; protoplast isolation, culture and regeneration; somatic hybridization; Applications: micropropagation, meristem culture, embryo rescue, synseed production, somaclonal and androclonal variations, cryopreservation and germplasm storage.

**UNIT-2-
18Hours** Principles, methods and applications of genetic transformation: Agrobacterium biology and biotechnology; Plant - Agrobacterium interactions; Direct gene transfer methods: particle bombardment, electroporation,

**UNIT-3-
18 Hours** Biotechnology of Biofertilizers
Biotechnology in forestry.

**UNIT-4-
18Hours** PEG-mediated and floral-dip; marker and reporter genes; case studies of transgenic traits in plants; marker-free transgenics; transgene silencing; environmental, social and legal issues.

**UNIT-5-
18Hours** Plant resource utilization : World centres of primary diversity and secondary centres of cultivated plants; crop domestication genes; Uses and introduction to current research paradigms in major cereals, oilseeds, legumes, medicinal plants, forest trees and non-alcoholic beverages.

**LABORATORY
WORK
(MBT213)**

1. Preparation of different types of standard tissue culture media.
2. Establishment of aseptic cultures following appropriate sterilization procedures using seeds.
3. Preparation of competent cells and Agrobacterium transformation by electroporation.
4. Agrobacterium tumefaciens-mediated transformation of tobacco.
5. Morphological and histochemical features of major cereals, oilseeds, legumes, forest trees, non-alcoholic beverages and medicinal plants.
6. Analysis of crude extracts from medicinal plants using HPLC.
7. Evaluation of a transgenic phenotype (viz., Herbicide resistance) under containment conditions in the field.

**SUGGESTED
READING
GS**

1. Adrian S, Nigel WS, Mark RF (2008). Plant Biotechnology: The genetic manipulation of Plants, Oxford University Press.
2. Buchanan B, Gruissem G and Jones R (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA. 14
3. Butenko RG (2000) Plant Cell Culture, University Press of Pacific.
4. Davies PJ (2004) Plant Hormones, Kluwer Academic Publishers, Netherlands.
5. Halford N (2006) Plant Biotechnology - Current and future applications of genetically modified crops, John Wiley and Sons, England.
6. Wickens GE (2004) Economic Botany: Principles and Practices, Springer, ISBN 978-0-7923-6781-9.

M.Sc (BOTANY)

COURSE CODE: MBTB 01

IInd SEMESTER

COURSE TITLE: FOREST AND ENVIRONMENTAL LAWS

COURSE TYPE: ECC

CREDIT: 06

HOURS: 90

THEORY: 06

THEORY: 90

MARKS: 100

THEORY: 80

CCA: 20

OBJECTIVE :

- Understands the concept and place of research in concerned subject
- Gets acquainted with various resources for research
- Becomes familiar with various tools of research
- Gets conversant with sampling techniques, methods of research and techniques of analysis of data
- Achieves skills in various research writings
- Gets acquainted with computer Fundamentals and Office Software Package .

UNIT - 1
18 Hrs

EVOLUTION OF FOREST AND WILD LIFE LAWS

- a) Importance of Forest and Wildlife
- b) Evolution of Forest and Wild Life Laws
- c) Forest Policy during British Regime
- d) Forest Policies after Independence.
- e) Methods of Forest and Wildlife Conservation.

UNIT - 2
18 Hrs

FOREST PROTECTION AND LAW

- a) Indian Forest Act, 1927
- b) Forest Conservation Act, 1980 & Rules therein
- c) Rights of Forest Dwellers and Tribal
- c) The Forest Rights Act, 2006
- d) National Forest Policy 1988

UNIT - 3
18 Hrs

WILDLIFE PROTECTION AND LAW

- a) Wild Life Protection Act, 1972
- b) Wild Life Conservation strategy and Projects.
- c) The National Zoo Policy

UNIT - 4
18 Hrs

CHAPTER - BASIC CONCEPTS

- a. Meaning and definition of environment.
- b. Multidisciplinary nature of environment
- c. Concept of ecology and ecosystem
- d. Importance of environment
- e. Meaning and types of environmental pollution.
- f. Factors responsible for environmental degradation.

CHAPTER- INTRODUCTION TO LEGAL SYSTEM

- a. Acts, Rules, Policies, Notification, circulars etc
- b. Constitutional provisions on Environment Protection
- c. Judicial review, precedents
- d. Writ petitions, PIL and Judicial Activism

CHAPTER – LEGISLATIVE FRAMEWORK FOR POLLUTION CONTROL LAWS

- a) Air Pollution and Law.
- b) Water Pollution and Law.
- c) Noise Pollution and Law.

CHAPTER- LEGISLATIVE FRAMEWORK FOR ENVIRONMENT PROTECTION

- a) Environment Protection Act & rules there under
- b) Hazardous Waste and Law
- c) Principles of Strict and absolute Liability.
- d) Public Liability Insurance Act
- e) Environment Impact Assessment Regulations in India

CHAPTER – ENVIRONMENTAL CONSTITUTIONALISM

- a. Fundamental Rights and Environment
 - i) Right to EqualityArticle 14
 - ii) Right to InformationArticle 19
 - iii) Right to LifeArticle 21
 - iv) Freedom of Trade vis-à-vis Environment Protection
- b. The Forty-Second Amendment Act
- c. Directive Principles of State Policy & Fundamental Duties
- d. Judicial Activism and PIL

UNIT - 5
18 Hrs

Bharucha, Erach. Text Book of Environmental Studies. Hyderabad : University Press (India) Private limited, 2005.

Doabia, T. S. Environmental and Pollution Laws in India. New Delhi: Wadhwa and Company, 2005.

Joseph, Benny. Environmental Studies, New Delhi: Tata McGraw-Hill Publishing Company Limited, 2006.

Khan. I. A, Text Book of Environmental Laws. Allahabad: Central Law Agency, 2002.

Leelakrishnan, P. Environmental Law Case Book. 2nd Edition. New Delhi: LexisNexis Butterworths, 2006.

Shastri, S. C (ed). Human Rights, Development and Environmental Law, An Anthology. Jaipur: Bharat law Publications, 2006.

Environmental Pollution by Asthana and Asthana, S, Chand Publication

Environmental Science by Dr. S.R.Myneni, Asia law House

Gurdip Singh, Environmental Law in India (2005) Macmillan.

Shyam Diwan and Armin Rosencranz, Environmental Law and Policy in India – Cases, Materials and Statutes (2nd ed., 2001) Oxford University Press.

JOURNALS :-

Journal of Indian Law Institute, ILI New Delhi.

Journal of Environmental Law, NLSIU, Bangalore.

MAGAZINES :-

Economical and Political Weekly

Down to Earth.

SUGGESTED
READING
GS

M.Sc (BOTANY)		IIND SEMESTER	
COURSE CODE: MBTB 02		COURSE TYPE: ECC/CB	
COURSE TITLE: SYSTEMATICS, EVOLUTION AND ENVIRONMENTAL SCIENCE			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/Plant Science.

**UNIT-1-
18 Hours**

Systematics and Evolutionary Biology : History of developments in taxonomy: Linnaean to post-Linnaean era; Systematics - concepts and components; Botanical Nomenclature; Evolutionary ecology- concepts and principles; Microevolution - theory and concepts; Species and speciation; Phylogenetic systematics;

**UNIT-2-
18Hours**

Macroevolution - inferring phylogenies; Diversity and classification of flowering plants; Taxonomic evidence - structural and biochemical; Molecular systematics;

**UNIT-3-
18 Hours**

Diversity and classification of flowering plants; Biological diversity-concepts and applications; Diversity- patterns, indices and applications.

**UNIT-4-
18Hours**

Environmental Science: Introduction to Environmental Science and Sustainability, Environmental laws, Ecosystems and living organisms,

**UNIT-5-
18Hours**

Major ecosystems of the world and India, Human health and environmental change, Population issues, the search for fuels, natural resources and their management, applications of GIS and RS technology in environmental studies, the future of planet earth.

SUGGES
TED
READIN
GS

1. Angiosperm Phylogeny Group (2003) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. *Botanical Journal of the Linnaean Society* 141: 399-436.
2. Cracknell AP, Hayes L (2009) *Introduction to Remote Sensing*. CRC Press, Boca Raton, USA (Special Indian Edition)
3. Crawford DJ (2003) *Plant Molecular Systematics*. Cambridge University Press, Cambridge, UK.
4. Cronquist A (1981). *An integrated system of classification of flowering plants*. Columbia University Press, New York.
5. Hollingsworth PM, Bateman RM and Gornall RJ (1999). *Molecular systematics and Plant Evolution*. Taylor and Francis, London.
6. Judd WS, Campbell CS, Kellogg EA, Stevens PA and Donoghue MJ (2002) *Plant Systematics: A Phylogenetic Approach*. Sinauer Associates, Inc., Massachusetts.
7. Nei M and Kumar S (2000) *Molecular Evolution and Phylogenetics*. Oxford University Press, New York.
8. Raven PH, Begl LR, Hassenzahl DM (2008) *Environment*. 6th edition. John Wiley & Sons, Inc., New York.
9. Semple C and Steel MA (2003) *Phylogenetics*. Oxford University Press, Oxford.
10. Simpson MG (2006) *Plant Systematics*. Elsevier, Amsterdam.
11. Stuessy TF (2008) *Plant Taxonomy: The systematic Evaluation of Comparative Data*. Columbia University Press, New York.
12. Swafford DL (2001) PAUP*. *Phylogenetic analysis using parsimony (* and other methods)*, version 4. Sinauer Associates, Sunderland.

Eligibility Criteria (Qualifying Exams)	Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per Week					EASE Duration (Hrs.)
					L	T	P	Th	P	
After appearing in the Second semester examination irrespective of any number of back/ arrears papers	MBT 301	CCC	ALGAE, ENVIRONMENT AND HUMAN WELFARE	5	4	2	00	3	00	
	MBT 311	CCC	ALGAE, ENVIRONMENT AND HUMAN WELFARE (PRACTICAL)	2	00	00	3	00	3	
	MBT 302	CCC	PRINCIPLES OF ECOLOGY	5	4	2	00	3	00	
	MBT 312	CCC	PRINCIPLES OF ECOLOGY (PRACTICAL)	2	00	00	3	00	3	
	MBT 303	CCC	ADVANCES IN ARCHEGONIATAE	5	4	2	00	3	00	
	MBT 313	CCC	ADVANCES IN ARCHEGONIATAE (PRACTICAL)	2	00	00	3	00	3	
	MBT 302	OSC	INTELLECTUAL PROPERTY, HUMAN RIGHTS & ENVIRONMENT /BASICS	6	4	3	00	3	00	
	MBT C01	ECC/CB	TRIBAL STUDIES							
	MBT C02	ECC/CB	MICROBES AND MICROBIAL TECHNOLOGY							
	MBT C03	ECC/CB	EVOLUTIONARY BIOLOGY							
	MBT C04	ECC/CB	BIOINFORMATICS, COMPUTATIONAL BIOLOGY AND BIOSTATISTICS	6	4	3	00	3	00	
	MBT C05	ECC/CB	GENOMICS AND PROTEOMICS							
MBT C06	ECC/CB	IMMUNOLOGY								
TOTAL=				33						

M.Sc (BOTANY)		IIIRD SEMESTER	
COURSE CODE: MBT301		COURSE TYPE: CCC	
COURSE TITLE: ALGAE, ENVIRONMENT AND HUMAN WELFARE			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

**UNIT-1-
18 Hours**

Diversity and distribution of the algae: Thallus organization, cell structure and reproduction in various groups. Chlamydomonas and Porphyra as modern experimental systems.

**UNIT-2-
18Hours**

Classification : Molecular taxonomy – recent developments in algal classification, special emphasis on emerging trends in molecular phylogeny and inter relationship of principal groups of algae.
The following groups will be covered: Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta.

**UNIT-3-
18 Hours**

Algal Biotechnology : Historical perspectives, algal culturing techniques in the laboratory, tissue and cell culture studies in seaweeds,

**UNIT-4-
18Hours**

Cryopreservation, aquaculture (micro and macro algae cultivation), bioremediation, recent developments and future of algal biotechnology; Algal biofuels – algal biodiesel, bio-ethanol and biological hydrogen production; Algae in global warming – carbon capture by algae.

**UNIT-5-
18Hours**

Industrial Phycology : Products, processes and applications, seaweeds polysaccharides like Agar, Carrageenan and Alginates. Bioactive compounds from algae: Bio-fertilizers; Algae in bioengineering, photo-bioreactors and raceway ponds.

**LABORATORY
WORK
(MDT311)**

1. Study of diversity of freshwater and marine algae.
2. Raising of pure culture.
3. Phytoremediation experiments
4. Microtechniques

**SUGGESTED
READINGS**

1. Andersen RA (2005). Algal Culturing Techniques. Physiological Society of America. Elsevier Academic Press, USA.
2. Cole KM and Sheath RG (1990). Biology of the Red Algae. Cambridge Univ. Press, Cambridge.
3. Fritsch FE (1945). The Structure and Reproduction of Algae. Vol. II. Cambridge Univ. Press. Cambridge, London.
4. Isabella A. Abbott, George J and Hollenberg (1993). Marine Algae of California. Stanford University Press. USA.
5. Lee RE (1989). Phycology. Vol. II. Cambridge Univ. Press. Cambridge, USA.
6. Sahoo D & Qasim SZ (Eds), (2002). "Sustainable Aquaculture". APH Publishing Corporation, New Delhi, India.
7. South GR and Whittick A. (1987). Introduction to Phycology. Blackwell Scientific Publications. London.

M.Sc (BOTANY)		IIIRD SEMESTER	
COURSE CODE: MBT302		COURSE TYPE:CCC	
COURSE TITLE: PRINCIPLES OF ECOLOGY			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science			
UNIT-1- 18 Hours	Introduction to ecology, evolutionary ecology, environmental concepts, Population ecology – characters of polulation, population growth, population dynamics life forms, age structure, fertility, growth curves, eades and ecotypes.		
UNIT-2- 18Hours	Nature of ecosystem, structure, component, productivity, food chain, food web, energy flow through ecosystem. Biogeochemical cycles – Carbon cycle, nitrogen cycle, phosphorus cycle, Sulpher. Ecosystem management, Community Ecology		
UNIT-3- 18 Hours	Environmental Stresses and their management, Global climatic pattern and variations over time, Global climatic changes, Global warming, acid rain and Nitrogen deposition. Ecological succession – Types, mechanism, changes involved in succession, concept of climax.		
UNIT-4- 18Hours	Biodiversity & Conservation, concept and levels, distribution and global patterns biodiversity act of India and related international conventions. Phytogeography, behavioral ecology, molecular ecology.		
UNIT-5- 18Hours	Environmental pollution air, water, soil pollution, use of fertilizer, pestisides and other chemicals in agriculture. Industrial pollution and impact of chemical on Biodiversity of microbes animals and plants. Seed and seedling ecology.		

**LABORATORY
WORK
(MBT312)**

1. Physical and chemical properties of soil
2. Assessing influence of light, temperature and moisture on plant germination.
3. To determine frequency, density and abundance of plant species in different terrestrial ecosystem using various techniques- transect, quadrat etc.
4. Comparison of stands/communities and ordination.
5. Soil profile diagram.
6. To compare protected and unprotected grassland ecosystem using community co-efficiency (similar indices).
7. Understanding ecosystem succession by studying various stages of vegetation /community assemblages development.
8. Molecular techniques in laboratory.
9. Principles of GIS and RS Technology

**SUGGESTED
READING**

1. Conklin, A.R. Jr. 2004. Field Sampling: Principles and Practices in Environmental Analysis. CRC Press.
2. Fahey, T.J. and Knapp, A.K. 2007. Principles and Standards for Measuring Primary Production. Oxford.
3. Grant, W.E. and Swannack, T.M. 2008. Ecological Modeling. Blackwell.
4. Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An Earth system Approach. Oxford.

M.Sc (BOTANY)		IIIRD SEMESTER	
COURSE CODE: MBT303		COURSE TYPE: CCC	
COURSE TITLE: ADVANCES IN ARCHEGONIATAE			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:34	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science

UNIT-1- 18 Hours
Bryophytes : Vegetative and reproductive innovations of early land plants, Role of bryophytes in ecosystem dynamics and in the global carbon budget, bryophyte association with microorganism and animals, Symbiotic fungal associations in early land plants

UNIT-2- 18Hours
 Poikelohydry, Desiccation tolerance. Bryogeography and conservation. Hormonal regulation of gametophyte development in bryophytes. Breeding system, population ecology and population genetics, Anisospory and sexual dimorphism. Biologically active compounds in Bryophytes. Cytogenetics of bryophytes, Molecular genetic studies of moss species.

UNIT-3- 18 Hours
Pteridophytes : Morphological diversity and evolution of vegetative organs in Pteridophytes, Diversity of Ferns - an ecological perspective, Genetics and reproductive biology of ferns, Culture of fern gametophyte for experimental investigation, photomorphogenesis, Model system in Ceratopteris, Trichomanes, Osmunda, Marsilea

UNIT-4- 18Hours
Gymnosperms : Evolution of pollination mechanisms and embryogeny of gymnosperms: propagation of conifers using plant tissue culture approaches, advances in synthetic seeds technology of conifers, somatic embryogenesis and plantlet regeneration;

UNIT-5- 18Hours
 Diversity of non living gymnosperms, morphological diversity and reproductive variations in cycadales, ginkgoales, coniferals and gnetales. Origin of vascular system in coniferals.
 Conifer plantation, uses and impact of coniferous forests on human life.

**LABORATORY
WORK
(MBT313)**

1. Study of structural modification in Marchantiiales, Junggermanniales, Isobryales and Hypnobryales.
2. Regeneration experiments, Effect of light, sugars and pH on regeneration.
3. Growth forms, water-holding capacity.
4. Effect of bryophyte extract on the growth of microbes.
5. Pollution Monitoring
6. Systematics in bryophytes and Pteridophytes.
7. Cytological studies on bryophytes and ferns
8. Evolution of reproductive pathways in Gymnosperms
9. Spore viability test. Male and female cone and pollen study in gymnosperms.

**SUGGESTED
READING**

1. Shaw AJ and B Goffinet (2000) Bryophyte Biology. Cambridge University Press.
2. Geissler and Greene SW (1982) Bryophyte Taxonomy, methods, practices and floristic exploration. J Cramer, Germany.
3. Dyer AF (Ed) (1979) The experimental Biology of Ferns. Academic London.
4. Richardson DHS (1981) The Biology of mosses. John Wiley & Sons, Inc New York.
5. Bhatnagar SP and Moitra A (1996) Gymnosperms. New Age International (P) Limited, Publishers, New Delhi
6. Singh Hardev (1978) Embryology of Gymnosperms. Encyclopedia of Plant Anatomy, Vol X Gebruder Borntraeger, Berlin, Stuttgart.

M.Sc (BOTANY)**IIIRD SEMESTER****COURSE CODE: MBT421****COURSE TYPE: 08C****COURSE TITLE: INTELLECTUAL PROPERTY RIGHTS, HUMAN RIGHTS & ENVIRONMENT: BASICS****CREDIT: 06****HOURS : 90****THEORY: 06****THEORY: 90****MARKS : 100****THEORY: 80****CCA : 20****OBJECTIVE:**

Understands the concept and place of research in concerned subject
 Gets acquainted with various resources for research
 Becomes familiar with various tools of research
 Gets conversant with sampling techniques, methods of research and techniques of analysis of data.

**UNIT - 1
12 Hrs**

- Patents :- Introduction & concepts, Historical Overview.
- Subject matter of patent.
- Kinds of Patents.
- Development of Law of Patents through international treaties and conventions including TRIPS
- Agreement.
- Procedure for grant of patents & term of Patent.
- Surrender, revocation and restoration of patent.
- Rights and obligations of Patentee
- Grant of compulsory licenses
- Infringement of Patent and legal remedies
- Offences and penalties
- Discussion on leading cases.

**UNIT - 2
24 Hrs**

- Meaning of Copyright, Historical Evolution,
- Subject matter of copyright.
- Literary works
- Dramatic Works & Musical Works
- Computer Programme
- Cinematographic films
- Registration of Copyrights
- Term of Copyright and Ownership of Copyrights
- Neighboring Rights
- Rights of Performers & Broadcasters
- Assignment of Copyright.
- Author's Special Rights (Moral Rights)
- Infringement of Copyrights and defenses
- Remedies against infringement (Jurisdiction of Courts and penalties)
- International Conventions including TRIPS Agreement WIPO, UCC, Paris Union, Berne
- Convention, UNESCO.
- Discussion on leading cases.

UNIT - 3
10 Hrs

- Rights: Meaning
- Human Rights- Meaning & Essentials
- Human Rights Kinds
- Rights related to Life, Liberty, Equals & Disable

UNIT-4
24 Hrs

- National Human Rights Commission
- State Human Rights Commission
- High Court
- Regional Court
- Procedure & Functions of High & Regional Court.

UNIT - 5
20 Hrs

- Rights: Meaning
- Human Rights- Meaning & Essentials
- Human Rights Kinds
- Rights related to Life, Liberty, Equals & Disable

SUGGE
STED

READI
NGS

1. G.B.Reddy, Intellectual Property Rights and Law, Gogia Law Agency, Hyderabad.
2. S.R.Myneni, Intellectual Property Law, Eastern Law House, Calcutta
3. P Narayanan Intellectual Property Rights and Law (1999), Eastern Law House, Calcutta, India
4. Vikas Vashistha, Law and Practice of Intellectual Property, (1999) Bharat Law House, New Delhi.
5. Comish W.R Intellectual Property, 3rd ed, (1996), Sweet and Maxwell
6. P.S. Sangal and Kishor Singh, Indian Patent System and Paris Convention,
7. Comish W.R Intellectual Property, Patents, Copyrights and Allied Rights, (2005)
8. Bibeck Debroy, Intellectual Property Rights, (1998), Rajiv Gandhi Foundation.

M.Sc (BOTANY)		IIIRD SEMESTER
COURSE CODE: MBTC 01		COURSE TYPE: EEC
COURSE TITLE: TRIBAL STUDIES		
CREDIT: 06		HOURS : 90
THEORY: 06		THEORY: 90
MARKS : 100		
THEORY: 80	CCA : 20	
OBJECTIVE:		
<ul style="list-style-type: none"> - Understands the concept and place of research in concerned subject - Gets acquainted with various resources for research - Becomes familiar with various tools of research - Gets conversant with sampling techniques, methods of research and techniques of analysis of data - Achieves skills in various research writings - Gets acquainted with computer Fundamentals and Office Software Package. 		
UNIT - 1 12 Hrs	Tribal Studies : Meaning, Nature, Scope, Need & importance of tribal studies. Meaning, Definition & characteristics of Tribe, Caste & Race.	
UNIT - 2 24 Hrs	Scheduled Tribe in India : Population Composition of tribal, classification of Indian Tribe – Racial, Lingual, Geographical, Cultural. Some Major Tribes in India : Santhal, Khasi, Munda, Bhils. Some Major Tribes in Central India : Gond, Baiga, Bharia, Korkus.	
UNIT - 3 10 Hrs	Illiteracy : Poverty, Indebtedness, Unemployment, migration & Exploitation Environmental & Degradation. Problem of Health and sanitation : Prostitution, Culture Decay due to assimilation. Replacement & Rehabilitation of Tribal population.	
UNIT - 4 24 Hrs	Welfare-Concept, Characteristics : Tribal Welfare in post independence period. Constitutional provision & safe guard after independence, Legislation & Reservation Policy.	
UNIT - 5 20 Hrs	Tribal Development Programs for Scheduled Tribes : Medical, Education, Economy, Employment & Agriculture Evaluation of Programs Tribal Welfare & Advisory Agencies in India : Role of NGO's in tribal development, Role of Christian missionaries in tribal welfare & development. Tribal Welfare Administration.	
SUGGESTED READING	<i>Tribal Development In India (Orissa)</i> by Dr. Taradutt <i>Books on Tribal studies</i> by PK Bhowmik <i>Books on 'Tribal Studies'</i> by W.G. Archer	

M.Sc (BOTANY)		III RD SEMESTER	
COURSE CODE: MBTC02		COURSE TYPE: ECC/CB	
COURSE TITLE: MICROBES AND MICROBIAL TECHNOLOGY			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science

UNIT-1- 18 Hours
General Microbiology : Diversity of the microbial world – Microbial taxonomy and phylogeny; Microbial nutrition, growth and metabolism; Genetics of bacteria and their viruses.

UNIT-2- 18Hours
Agricultural Microbiology: Agriculturally important microorganisms; Biological nitrogen fixation; Mycorrhizae, microbial mineralization, Biocontrol of plant diseases, Plant growth promoting rhizobacteria (PGPR).

UNIT-3- 18 Hours
Environmental Microbiology : Microbes and quality of environment; Distribution and implications of microbes in air – bio-aerosols, microbial flora of water, water pollution, drinking water and domestic waste treatment systems;

UNIT-4- 18Hours
Microbial pesticides, Biotransformations: microbial degradation of pesticides and toxic chemicals, biodegradation of the agricultural residues, bioremediation of contaminated soils and water. Microbes in nanotechnology, biosensors; Microbes in extreme environments

UNIT-5- 18Hours
Food and Industrial Microbiology : Recent developments in food and industrial microbiology – Fermentation, fermented foods, fermenter design and growth processes, food spoilage, methods of food preservation; Microbes in recovery of metal (bioleaching) and oil, Recombinant-DNA technology; Cell and enzyme immobilization, microbial enzymes of industrial interest; Novel medicines from microbes.

SUGGESTED READINGS

1. Prescott L, Harley J, Klein D (2005) Microbiology, 6th edition, Mc Graw-Hill.
2. Singh VP and Stapleton RD (Eds.) (2002) Biotransformations: Bioremediation Technology for Health and Environmental Protection. "Progress in Industrial Microbiology Vol. 36", Elsevier Science.
3. Subba Rao NS (1982) Advances in Agriculture Microbiology, Butterworth-Heinemann.
4. Subba Rao NS and Dommergues YR (Eds.) (2001) Microbial Interactions in Agriculture and Forestry Vol. 2, Science Pub. Inc.
5. Waites MJ, Morgan NL, Rockey JS, Higton G (2001) Industrial Microbiology : An Introduction, Wiley-Blackwell.

M.Sc (BOTANY)		III RD SEMESTER	
COURSE CODE: MBTC03		COURSE TYPE: ECC	
COURSE TITLE: EVOLUTIONARY BIOLOGY			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science			
UNIT-1 18 Hours	Introduction: Evolutionary Biology before Darwin, Darwin, after Darwin. Evolutionary synthesis. Fact and theory.		
UNIT-2 18Hours	Biological diversity : Species and classification. Phylogenetic trees, reading and using trees. Tree of Life. The fossil record. Geological fundamentals. Phylogeny and the fossil record. Evolutionary trends. Rates of evolution. The geography of life. Major patterns of distribution. Historical biogeography, phylogeography. Genetic diversity: Genes, genomes, mutations, karyotypes. Sources of phenotypic variation. Genetic variation in populations. Variation among populations.		
UNIT-3 18 Hours	Molecular evolution : Neutral theory of molecular evolution natural selection, adaptation in action, level of selection, genetical theory of natural selection, conflict and co-operation, species and speciation, co-evolution.		
UNIT-4 18Hours	Macroevolution : The evolutionary time scale- era, period, epoch, major events in evolution time scale, origin of unicellular and multicellular organisms, species trees, pattern of evolutionary change. Adaptive radiation evolution and development.		
UNIT-5 18Hours	Biodiversity and its conservation: Rare, endangered species, conservation strategies. Biodiversity monitoring and documentation, alpha diversity, beta diversity. Major drivers of bio diversity changes, bio technical approaches in biodiversity conservation. The future of biodiversity.		
SUGGESTED READING GS	<ol style="list-style-type: none"> 1. David Briggs, Stuart Max Walters (1997). Plant Variation and Evolution, Cambridge University Press. 2. Douglas J. Futuyma (1998). Evolutionary Biology (3rd Edition), Sinauer Associates. 3. Mark Ridley (2003) Evolution (3rd edition), Blackwell. 4. Roderic D. M. Page, Edward C. Holmes (1998). Molecular Evolution: A Phylogenetic Approach, Blackwell. 5. Scott R, Freeman and Jon C. Herron (2003). Evolutionary Analysis, Prentice Hall 		

M.Sc (BOTANY)		III RD SEMESTER	
COURSE CODE: MBTC04 COURSE TYPE: ECC/CB			
COURSE TITLE: BIOINFORMATICS, COMPUTATIONAL BIOLOGY AND BIOSTATISTICS			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1- 18 Hours	Bioinformatics and Computational Biology : 1. Databases - NCBI, EMBL, DDBJ, Genbank, Pubmed, Patent databases, TAIR, PDB, ATIDB). 2. Online tools - BLAST, ORF finder, Primer3, protein motif and structure prediction tools; Vector NTI, DNASTAR. 3. Bioinformatics in genome sequencing and annotation. 4. Fundamentals of computer programming. 5. Programming in PERL. 6. Introduction to in silico drug design and molecular modeling.		
UNIT-2- 18Hours	Biostatistics: 1. Introduction : The scope of biostatistics; Classification of study design, Observational studies and Experimental studies (uncontrolled studies, trials with external controls, crossover studies, trials with self controls, trials with independent concurrent controls). 2. Exploration and presentation of data : Scales of measurement, Tables, Graphs, Histograms, Box and Whisker plots, Frequency polygon, Scatter Plots.		
UNIT-3- 18 Hours	3. Descriptive statistics : measures of central tendency, measures of dispersion, rates and proportions. 4. Probability : Definition, mutually exclusive events and addition rule, independent events and multiplication rule. Sampling: Reasons for sampling, methods of sampling, SRS, Systematic, Stratified, Cluster, NPS. Probability distribution: Binomial, Poisson, Gaussian, Standard normal distribution. Drawing inferences from data: Confidence intervals, Confidence limits, Hypothesis tests, Types of errors, P-values.		
UNIT-4- 18Hours	5. Estimating and comparing means: Decision about single mean (normal population and non-normal population), decision about single group, decision about paired groups, decision about two independent groups, equality of population variances, computer-aided illustration for comparison of means. 6. Comparing three or more means: ANOVA – one way, two way, A priori comparison, Posterior or Post Hoc comparison, randomized block design, LSD, Kruskal-wallis one way ANOVA. 7. Estimating and comparing proportions: Proportion in single group, Comparing two independent proportions, Risk ratios v/s χ^2 , comparing proportions in more than two groups, comparing proportions in paired groups, χ^2 as goodness of fit.		
UNIT-5- 18Hours	8. Correlation and Regression: Pearson's correlation coefficient, Spearman's rho, Linear regression, Least Square method, Predicting with regression equation, Comparing two regression lines, Dealing with nonlinear observation, Common errors in regression, Comparing correlation and regression. 9. Statistical methods for multiple variables: Multiple regression, Predicting with more than 1 variable, Statistical test for regression coefficient, Role of R and R ² in multiple regression, Confounding variable (ANACOVA), Predicting categorical outcomes – logistic regression, discriminant analysis		

1. Altwood TK and Parry-Smith DJ (2004) Introduction to Bioinformatics, Pearson Education (Singapore) Pvt. Ltd.
2. David Edwards (Ed.) (2007) Plant Bioinformatics: Methods and Protocols, Humana Press, New Jersey, USA.
3. Kulas JT (2008) SPSS Essential: Managing and Analyzing Social Science Data. John Wiley & Sons, New York.
4. Pagano M, Gauvreau K (2007) Principles of Biostatistics. Thomson India Edition, New Delhi.
5. Randal Schwartz, Tom Phoenix and Brian d Foy (2005) Learning Perl (4th edition), O'Reilly & Associates, ISBN: 0-596-10105-8.
6. Rex A. Dwyer (2004) Genomic Perl: From Bioinformatics Basics to Working Code, Cambridge University Press, 1st South Asian Edition.
7. Rosenkrantz WA (2009) Introduction to Probability and Statistics for Science, Engineering and Finance. CRC Press, Boca Raton.

M.Sc (BOTANY)

IIIIRD SEMESTER

COURSE CODE: MBTC05 COURSE TYPE: ECC/CB

COURSE TITLE: GENOMICS AND PROTEOMICS

CREDIT:6

HOURS:90

THEORY: 6

PRACTICAL:0

THEORY:90

PRACTICAL: 00

MARKS

THEORY: 100 (20+80)

PRACTICAL:00

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

UNIT-1-
18 Hours

Genomics : Genome sequencing strategies and programs, new technologies for high through put sequencing, methods for sequence alignment and gene annotation; Approaches to analyze differential expression of genes - ESTs, SAGE

UNIT-2-
18Hours

Microarrays and their applications; gene tagging; gene and promoter trapping; knockout and knock-down mutants; dynamic modulation of protein structure and function; Comparative genomics of model plants and related crop species; Recombination-based cloning techniques; RNAi and gene silencing, genome imprinting, small RNAs and their biogenesis, role of small RNAs in heterochromatin formation and gene silencing, genomic tools to study methylome and histone modifications.

UNIT-3-
18 Hours

Proteomics: Analysis of proteins by different biochemical and biophysical procedures like CD (Circular Dichroism), NMR, UV/Visible and fluorescent spectroscopy, protein identification and analysis on ExPASy server, other protein related databases, 1-D and 2-D gel electrophoresis for proteome analysis

UNIT-4-
18Hours

Sample preparation, gel resolution and staining; Mass spectrometry based method for protein identification like PMF (protein mass fingerprinting) and LCMS; Image analysis of 2D gels: Data acquisition, spot detection & quantitation, gel matching, data analysis, presentation, databases, conclusions; DIGE (Differential In Gel Electrophoresis)

UNIT-5-
18Hours

Alternatives to 2-DE for protein expression analysis; Analysis of post-translational modifications and protein-protein interactions; protein chips and arrays, future directions in proteomics, scope of functional proteomics.

SUGGESTED
READING
GS

1. Buchanan B, Gruissem G, and Jones R (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA.
2. Hammes GD (2005) Spectroscopy for the Biological Sciences; Wiley Interscience, USA.
3. Harlow and Lane D (Eds.) (1988) Antibodies - A Laboratory Manual; Cold Spring Harbor Laboratory, USA.
4. Lieber DC (2006) Introduction to Proteomics: Tools for New Biology; Humana Press, NJ.
5. Pennington SR, Dunn MJ (Eds.) (2002) Proteomics: From Protein Sequence to Function, BIOS Scientific Publishers, United Kingdom.
6. Sambrook J and Russell DW (2001). Molecular Cloning - A Laboratory Manual, Vols I - III, Cold Spring Harbor Laboratory, USA.
7. Singer M and Berg P (1991). Genes and Genomes: A Changing Perspective; University Science Books, CA, USA.

M.Sc (BOTANY)		IIIRD SEMESTER	
COURSE CODE: MBTC06		COURSE TYPE: ECC/CB	
COURSE TITLE: IMMUNOLOGY			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science			
UNIT-1- 18 Hours	Fundamentals of Immunology: Basic principles and overview of Immunity, antigens and antibody production, cellular interactions in the immune system, Innate Immunity, Complement, antibody structure and antigen recognition		
UNIT-2- 18Hours	Immunoglobulin genes, Ig/TCR gene rearrangement and generation of diversity, Introduction to Immunogenetics & the MHC		
UNIT-3- 18 Hours	Antigen recognition by T cells, TCR, Co-receptors & MHC structure, antigen processing and presentation.		
UNIT-4- 18Hours	Immunity in Health & Disease: Immune response to infectious diseases, Immunodeficiency and AIDS		
UNIT-5- 18Hours	Hypersensitivity, transplant rejections, autoimmunity, vaccines, evolution of the immune system.		
SUGGESTED READINGS	1. Kuby Immunology; by Richard A. Goldsby, Thomas J, Kindt, Barbara A. Osborne, Janis Kuby, W. H. Freeman Publishing (4e-6e).		

Eligibility Criteria (Qualifying Exams)	Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)	
					L	T	P	Thy	P
After appearing in the Third semester examination irrespective of any number of back/ arrear papers	MBT 401	CCC	IN VITRO TECHNOLOGIES AND INDUSTRIAL APPLICATIONS	5	4	2	00	3	00
	MBT 411	CCC	IN VITRO TECHNOLOGIES AND INDUSTRIAL APPLICATIONS (PRACTICAL)	2	00	00	3	00	3
	MBT 40A2	CCC	REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS	5	4	2	00	3	00
	MBT 412	CCC	REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS	2	00	00	3	00	3
	MBT 403	CCC	MOLECULAR INTERACTIONS OF PLANTS WITH SYMBIONTS, PATHOGENS & PESTS	5	4	2	00	3	00
	MBT 413	CCC	MOLECULAR INTERACTIONS OF PLANTS WITH SYMBIONTS, PATHOGENS AND PESTS (PRACTICAL)	2	00	00	3	00	3
	MBT 421	SSC/PRJ	DISSERTATION	6	00	00	9	00	4
	MBT D01	ECC/CB	ADVANCED GENETICS AND PLANT BREEDING	6	4	3	00	3	00
	MBT D02	ECC/CB	AGRICULTURAL ECOLOGY - PRINCIPLES AND APPLICATIONS						
	MBT D03	ECC/CB	ADVANCED PLANT SYSTEMATICS						
MBT D04	ECC/CB	CONTEMPORARY CONCEPTS AND METHODS IN CELL BIOLOGY							
MBT D05	ECC/CB	PLANT PHYSIOLOGY AND BIOCHEMISTRY	Total=33						

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBT301		COURSE TYPE: CCC	
COURSE TITLE: IN VITRO TECHNOLOGIES AND INDUSTRIAL APPLICATIONS			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:33	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1 18 Hours	To provide students with an overview of plant tissue culture techniques, their potential in the production of propagative material and interaction with industries) Micropropagation (via organogenesis and embryogenesis) of floricultural, agricultural and pharmaceutical crops: Orchids, Chrysanthemum, Gerbera, Carnation, Anthurium, Bamboos, Spilanthes, Stevia, Psoralea, Chickpea and elite tree species of national importance		
UNIT-2 18Hours	Production of virus free plants through meristem culture in orchids and fruit trees. Germplasm conservation <i>in vitro</i> . Germplasm conservation <i>in vivo</i>		
UNIT-3 18 Hours	Variations: Somaclonal and gametoclonal variations, spontaneous, genetic and epigenetic variations. Culture systems: Differentiated, undifferentiated, physiological, biochemical and molecular role of minerals and growth regulators in understanding differentiation of organs under in vitro conditions.		
UNIT-4 18Hours	Problems in Plant Tissue Culture; contamination, phenolics, recalcitrance. Problems in establishment of regenerated plants in nature: hardening, association of mycorrhiza and rhizobia. Factors responsible for in vitro and ex vitro hardening.		
UNIT-5 18Hours	Use of bioreactors in secondary metabolite production and scale up automation of plant tissue culture. Recent applications of tissue culture techniques and biotechnology in the introduction of economically important traits in horticultural, agricultural and medicinal plants. Interactions, training and workshops in Biotech industries and placements.		

1. Development of regeneration protocols employing direct and indirect organogenesis /somatic embryogenesis in economically important horticultural and/or medicinal plants.
2. Control of phenolics in recalcitrant tissues under culture conditions.
3. Study of various physico-chemical factors (pH, light, hormones, etc.) on in vitro growth and development of tissues or organs, rooting of regenerants, in vitro and ex vitro hardening, potting and acclimatization in natural conditions.
4. Shoot-tip meristem culture for raising virus-free plants in tomato / tobacco.
5. Agrobacterium rhizogenes mediated development of hairy root cultures.
6. Isolation of bioactive compounds from medicinal plants using column chromatography and TLC.
7. Preparation of synthetic seeds for germplasm conservation using somatic embryos or other propagules

1. Herman EB (2008) Media and Techniques for Growth, Regeneration and Storage 2005-2008. Agritech Publications, New York, USA.
2. Pierik RLM (1999) In Vitro Culture of Higher Plants. Kluwer Academic Publishers.
3. Prakash J & Pierik RLM (1991) Horticulture - New Technologies and Applications (Current Plant Science and Biotechnology in Agriculture). Kluwer Academic Publishers.
4. George EF, Hall MA and Geert-Jan De Klerk (2008). Plant Propagation by Tissue Culture (3rd Edition), Springer, Netherlands.
5. Journals: Plant Cell, Tissue and Organ Culture, Plant Cell Reports.

M.Sc (BOTANY)**IVTH SEMESTER****COURSE CODE: MBT402****COURSE TYPE: CCC****COURSE TITLE: REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS****CREDITS: 7****HOURS: 135****THEORY: 5****PRACTICAL: 2****THEORY: 100****PRACTICAL: 45****MARKS****THEORY: 100 (20+80)****PRACTICAL: 33**

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

**UNIT-1-
18 Hours**

**Modes of Reproduction: An overview-
Flower development: Regulation of floral architecture and diversification; Floral organogenesis; Pollination regulation of flower development**

**UNIT-2-
18Hours**

Male gametophyte: Sporophyte-gametophyte interaction during micro- and megasporogenesis; interaction of mitochondrial and nuclear genes; male specific cytokinesis; tapetal development and pollen-coat formation; asymmetric division, cell fate and polarity; sperm dimorphism; male germ unit: cytology and 3-d structural organization; pollen biotechnology; manipulation of sperm cells; male-sterility; induction; mechanism of action and breeding;

**UNIT-3-
18 Hours**

Pollen-pistil interaction and double fertilization: Pollen tube guidance; recognition and rejection reaction, barriers to gene flow; signal transduction at the level of stigma style and ovules, double fertilization: origin, mechanism and in vitro fertilization; preferential fertilization; pistil activation and ovule penetration.

**UNIT-4-
18Hours**

Plant-pollinator interactions and breeding systems: Plant-pollinator interaction: floral display, attractants and rewards, pollen load, temporal details and foraging behaviour, pollinator and pollination efficiency, physicochemical aspects of pollination; pollination energetics, gene flow, applied pollination ecology; phenology; mating systems: diversity and quantitative estimation; differential reproductive success; resource allocation; pollen:ovule ratio; sibling rivalry, ovule abortion.

UNIT-5.
18 Hours

Fruit biology: Development biology and diversity of fruit types, fruit abortion in relation to resource allocation, dispersal and gene flow.
Seed biology: Embryogenesis and embryonic pattern formation; endosperm development and differentiation; ultrastructure and cytology; seed development: pattern, regulation of gene expression and imprinting; agamospermy and parthenocarpy, pseudogamy and autonomous development of endosperm;
Embryo and endosperm culture.

LABORATORY WORK
(MBT412)

1. Study of developmental aspects of reproduction using Arabidopsis mutants.
2. Isolation of embryo sacs and visualization of post-fertilization stages with the help of fluorescence and confocal microscope.
3. Study of micro-and megasporogenesis using Nomarski interference microscope.
4. Microtomy of resin-embedded and wax-embedded material.
5. Determination of mating systems using Isozymes/DNA markers.
6. Study of pollination syndromes and plant-pollinator interaction.
7. Measuring floral sex allocation based on biomass.
8. Assessment of floral rewards: quantitative and qualitative analysis of nectar and pollen.
9. Assessment of attraction of insects to artificial flowers and determining pollination energetics.
10. Demonstration of in-situ expression of anther/ovule specific genes.
11. Induction of somatic embryos using a suitable plant material.
12. Study of types of embryo sacs during apomictic development by employing ovule-clearing method.

LABORATORY WORK
(MBT412)

1. Barrett SCH (2008) Major Evolutionary Transitions in Flowering Plant Reproduction. Univ. of Chicago Press.
2. Faegri K & van der Pijl L (1979) The Principles of Pollination Ecology. Pergamon Press, Oxford. 291 pp.
3. Harder LD & Barrett SCH (2006) Ecology and Evolution of Flowers, Oxford Univ. Press.
4. O'Neill SD & Roberts JA (2002) Plant Reproduction, Sheffield Academic Press.
5. Raghavan V (1997) Molecular Embryology of Flowering Plants, Cambridge Univ. Press.

6. Raghavan V (2000) *Developmental Biology of Flowering Plants*, Springer Verlag, New York.
7. Richards AJ (1986) *Plant Breeding System*, George Allen and Unwin, UK.
8. Scott RJ and Stead AD (2008) *Molecular and Cellular Aspects of Plant Reproduction*. Society for Experimental Biology, Seminar Series 55.
9. Shivanna KR and Johri BM (1985) *The Angiosperm Pollen: Structure and Function*. New Delhi, India: Wiley-Eastern.
10. Shivanna KR and Rangaswamy NS (1992) *Pollen Biology: A Laboratory Manual*, Springer- Verlag, Berlin.
11. Shivanna KR (2003) *Pollen Biology and Biotechnology*. Enfield, New Hampshire, U.S.A.: Science Publishers.

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBT403		COURSE TYPE: CCC	
COURSE TITLE: MOLECULAR INTERACTIONS OF PLANTS WITH SYMBIONTS, PATHOGENS AND PESTS			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 45
MARKS			
THEORY: 100 (20+80)		PRACTICAL:34	
OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.			
UNIT-1- 18 Hours	1. Introduction to biotic interactions with plants.		
UNIT-2- 18Hours	2. Recent advances in plant-fungi, plant-insect and plant-nematode interactions: Stages of pathogenesis		
UNIT3- 18 Hours	3. Recent advances in symbiotic interaction with plant with special references to mycorrhiza and plant interaction.		
UNIT-4- 18Hours	4. Recent advances in parasitic interaction between plants and parasitic plants.		
UNIT-5- 18Hours	Engineering for the production of resistance plants to pathogens and pests.		
LABORATORY WORK (MBT413)	1. Study on susceptible and resistance interactions at cellular and biochemical levels between plants and pathogens, and between plant and pests.		
	2. Investigation of infection cycle of a plant parasitic nematode (e.g., root knot nematode, <i>Meloidogyne incognita</i>) in susceptible and resistant tomato roots in the absence and presence of resistance genes (Mi gene).		
	3. Estimation of activity of phenylalanine ammonia lyase in healthy and disease leaves.		
	4. Detection of plant viruses from infected leaf tissues using ELISA and Western Blot.		
	5. Computer-based study of a multigene family pathogenicity gene from the Nem databases.		
	6. Field visit to show diseases on crop plants		

1. Williamson VM, Kumar A (2006) Nematode resistance in plants: the battle underground. *Trends in Genetics* 22: 396-403.
2. Davis EL, Hussey RS, Baum TJ (2004) Getting to the roots of parasitism by nematodes. *Trends in parasitology* 20: 134-141.
3. Plant Nematology (2006) Edited by Perry and Moens, CABI, *Plant virology and insect-plant interactions*.
4. Induced responses to herbivory by R Karban and IT Baldwin (1997) Chicago University Press, Chapter 3, pg47-100.
5. Mathew's Plant Virology by Roger Hull (2001) Academic Press, NY. *Plant-fungi interactions*:
6. *Plant resistance mechanisms (SAR, ISR)* - Strange RN, (2003) Introduction to Plant Pathology, John Wiley & Sons, USA.
7. *Signal transduction; Molecular diagnostics; Transgenic approaches for crop protection* - Dickinson M, (2003) Molecular Plant Pathology, Bios Scientific Publishers, London.

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBTD01		COURSE TYPE: CCC	
COURSE TITLE: ADVANCED GENETICS ANDm PLANT BREEDING			
CREDIT:7		HOURS:90	
THEORY: 5	PRACTICAL:2	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
<p>OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.</p>			
<p>UNIT-1- 18 Hours</p>	<p>1. Origin and history of crop plants: Plant domestication - morphological, agronomic and genetic features accompanying domestication of plants, agro- biodiversity, genetic erosion.</p>		
<p>UNIT-2- 18Hours</p>	<p>Biological diversity and genetic variation: Kinds and patterns of variation, variation and variability; genetics, utilization and analysis of genetic variation; qualitative and quantitative traits and their genetics, polygenic inheritance, partitioning of genotypic variance, inbreeding heterosis, recent development in quantitative genetics. Variation in population, genetic structure of population.</p>		
<p>UNIT-3 18 Hours</p>	<p>Genetic system and breeding methods: Reproduction and breeding systems in plants. Recombination, genetic control and manipulation of breeding systems including male sterility and apomixis. Selection and breeding strategies for self-pollinated, cross-pollinated and clonally propagated crop plants, breeding for crop quality, biotic and abiotic stresses, gene pyramiding for multi-trait incorporation.</p>		
<p>UNIT-4- 18Hours</p>	<p>Sources of variation: Plant genetic resources-genetic consideration on PGR management and conservation, utilization of gene pools in breeding programs; Access and ownership of PGR changing paradigms and their implications. Chromosome manipulation, induced mutations, polyploidy, somatic hybridization, somaclonal variation, novel sources of variation; molecular markers and construction of linkage maps; QTL mapping; map-based cloning, synteny, MAS (marker assisted selection), tagging of agronomically important traits.</p>		

UNIT-5-
18 Hours

Plant genome and crop improvement: Cytogenetics and its role in evolution and improvement of crops such as wheat, maize, sugarcane, Brassica etc.; location and mapping of genes on chromosomes, molecular cytogenetics. Genome analysis – modern approaches, biochemical and molecular tools for the analysis of plant genome including protein and DNA based techniques; structural and functional genomics in relation to crop improvement.

World food demand vis-à-vis availability: Food availability – International and Indian scenario, national and international agencies for agricultural R&D, green revolution, IPR and post-CBD changing paradigms.

SUGGESTED READING S

1. Acquaah G (2007). Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.
2. Allard RW (1999). Principles of Plant Breeding (2nd Edition), John Wiley and Sons, ISBN 0471023094, 9780471023098.
3. Hartl and Jones (2007). Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers.
4. Hartwell, Hood, Goldberg, Reynolds, Silver, Veris (2006). Genetics – From Genes to Genomes, 3rd edition, McGraw Hill.
5. Lewin B (2008). Genes IX, Jones and Barlett Publishers, ISBN-10: 0763740632.
6. Ram J. Singh (2002). Plant Cytogenetics, 2nd edition, CRC Press.
7. Simmonds (1995). Evolution of Crop Plants (2nd Edition) Longman.
8. Strickberger (2008). Genetics, 3rd Edition, Pearson (Prentice Hall).

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBTD02		COURSE TYPE: ECC/CR	
COURSE TITLE: AGRICULTURAL ECOLOGY - PRINCIPLES AND APPLICATIONS			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
<p>OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.</p>			

UNIT-1- 18Hours	<p>Soil type and classification; soil properties and environmental factors; Nitrogen in agroecosystems; fertilizer elements in the environment; Macro and micronutrients and their availability to crops; Decomposition: beneficial soil organisms; Plant succession and competition.</p>
UNIT-2- 18Hours	<p>Weed ecology and management; Distribution and sampling of agricultural pests; introduction to insects; Population dynamics; pesticides and the environment; Traditional knowledge systems and agrodiversity management;</p>
UNIT-3- 18Hours	<p>Plant disease and environment; integrated pest management; plant-parasitic nematodes; Host plant resistance and conservation of genetic resources; Cropping systems and agro-ecosystems in the landscape;</p>
UNIT-4- 18Hours	<p>Crop rotation and cover crops; Intercropping; conservation tillage; Mulches and organic amendments; Dry-land agriculture, irrigation and salinity;</p>
UNIT-5- 18Hours	<p>Tropical agro-ecosystems; intensive agriculture; Impact of GMOs on crop biodiversity and agroecology; Impact of agricultural policies on crop biodiversity and agroecology; Human population growth; sustainable agriculture; Agroecology: the future perspective.</p>

1. Gliessmann, S.R. (2006). **Agroecology: The Ecology of Sustainable Food Systems. Technology & Engineering.**
2. Gliessmann, S.R. (2006). **Field and Laboratory Investigations in Agroecology. Technology & Engineering.**
3. Paul A. Wojtkowski, P.A. (2004). **Landscape agroecology, Haworth Press, Inc., New York. 330 pp.**
4. Warner, K.D. (2007). **Agroecology in Action: Extending Alternative Agriculture Through Social Networks. The MIT Press, Cambridge, Massachusetts, USA, 291 pp.**

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBTD03		COURSE TYPE: CCC	
COURSE TITLE: ADVANCED PLANT SYSTEMATICS			
CREDIT:7		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	
<p>OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.</p>			
UNIT-1- 18 Hours	<p>Plant systematics: The Components of systematics, Major objectives of systematics; Relevance to society and science. Taxonomic History: Natural systems to cladistics: Natural systems; Phyletic systems; Phenetics; Cladistics.</p>		
UNIT-2- 18Hours	<p>Botanical Nomenclature: Kinds of names; International Code of Botanical Nomenclature, Names according to rank; Citation of authors; Priority; Type method; Naming a new species; Legitimacy; Synonyms</p>		
UNIT-3- 18Hours	<p>Classification: The components of classification; Characters and their states; Sources of characters; Evaluation of characters. Systematic evidence: Morphology, Anatomy and ultrastructure; Embryology; Palynology; Cytology; Phytochemistry.</p>		
UNIT-4- 18Hours	<p>Molecular Systematics: Plant genomes: nuclear, mitochondrial, chloroplast; Molecular markers; Generating molecular data: restriction site mapping, gene sequencing; Analysis of molecular data: alignment of sequences, methods of phylogeny reconstruction. Phylogenetics: The nature of phylogeny; How we depict phylogeny?; The importance of homology, Polarizing characters of homology; Rooting Trees; The problem of homoplasy.</p>		
UNIT-5- 18Hours	<p>The plant systematics community: Professional organizations; Work environment; Activities; The role of field studies; The role of the herbarium. Introduction to the angiosperms: General characteristics; Evolutionary history; Basal angiosperms and Magnoliids; Basal monocots; Petaloid monocots; Commelinids; Basal eudicots and Caryophyllids; Rosids; Asterids.</p>		

1. Angiosperm Phylogeny Group 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnaean Society 141: 399-436.
2. Crawford, D.J. 2003. Plant Molecular Systematics. Cambridge University Press. Cambridge, UK.
3. Cronquist, A. 1981. An integrated system of classification of flowering plants. Columbia University press, New York.
4. Judd, W.S., C.S. Campbell, E.A. Kellogg, P.F. Stevens and M.J. Donoghue 2002. Plant Systematics: A phylogenetic Approach. Sinauer Associates, Inc., Massachusetts.
5. Maheshwari, J.K. 1963. The Flora of Delhi, CSIR, New Delhi.
6. Nei, M. and S. Kumar 2000. Molecular Evolution and Phylogenetics. Oxford University Press, New York.
7. Rasford, A.E.; W.C. Dickison, J.R. Massey and C.R. Bell 1974. Vascular Plant. Systematics. Harper and Row, New York.
8. Semple, C. and M.A. Steel 2003. Phylogenetics. Oxford University Press, Oxford.
9. Simpson, M.G. 2006. Plant Systematics. Elsevier, Amsterdam.
10. Stuessy, T.F. 2009. Plant Taxonomy: The systematic Evaluation of Comparative Data. Columbia University Press, New York.

M.Sc (BOTANY)		IVTH SEMESTER	
COURSE CODE: MBTD04		COURSE TYPE: CCC/CB	
COURSE TITLE: CONTEMPORARY CONCEPTS AND METHODS IN CELL BIOLOGY			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY:90	PRACTICAL: 00
MARKS			
THEORY: 100 (20+80)		PRACTICAL:00	

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

UNIT-1-
18 Hours

Infective particles and life forms: prions, viroids, origin and evolution of various life forms, cell theory vs. cell body concept, multicellularity vs. supracellularity.
Cell Wall: temporal and spatial dynamism in structure, structural and functional roles, in planta and *ex planta* uses, cell wall biotechnology

UNIT-2-
18Hours

Biological membranes: from PLP model to Dynamically Structured Mosaic Model, transport through membranes, membranes as sites and routes of intra- and inter-organism and environment interactions
Cytoplasmic components: Endomembranes, organellar architecture, protein sorting and vesicular traffic

UNIT-3-
18Hours

Biopolymers: Structural and functional aspects of cytoskeleton and associated motor molecules, their role in cell organization and movement, interaction among cytoskeletal elements, genomics, proteomics and bioinformatics of plant cytoskeleton; cytoskeleton in agrobiotechnology

UNIT-4-
18Hours

Nucleus: detailed structure of nuclear pore complex and nuclear lamina, nuclear transport;
chromatin subunit structure: from DNA to metaphase chromosome, histone code, states of chromatin during replication and transcription, heterochromatization as a method of gene regulation
Cell turnover: cell division, cell cycle controls, breakdown of cell cycle control: cancer vs. Plant tumors, programmed cell death.

Cells to tissues: Cell polarity, cell fate determination, integration of plant cells in tissues. Introduction to methods in plant cell biology: optical and electron microscopy, fluorescent probes, flow cytometry, transient expression, microinjection and micromanipulation, electrophysiological methods, plant histology, immunocytochemistry, in situ hybridization, cell fractionation and organelle isolation

Book:

1. Alberts B, Johnson A, Lewis J, Raff Martin, Roberts K and Walter P. (2007). *Molecular Biology of the Cell*. Garland Publ., New York.
2. Bonifacino JS, Dasso M, Harford JB, Liipincott-Svhwartz J and Yamada KM. (2004). *Short Protocols in Cell Biology*. John Wiley Sons, New Jersey.
3. Bregman AA. (1987). *Laboratory Investigations in Cell Biology*. John Wiley Sons, New York.
4. Buchanan et al. 2002. *Biochemistry & Molecular Biology of Plants* 1st edition, American Society of Plant Physiologists: Chapter 4, pp. 160-201 & Chapter 5 pp. 202-256.
5. Hawes C and Satiat-Jeunemaitre B. (2001). *Plant Cell Biology: Practical Approach*. Oxford University Press, Oxford.
6. Karp G. (2008). *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.
7. Lodish H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H and Matsusaire P (2008).
8. Ruzin SE (1999). *Plant Microtechnique and Microscopy*. Oxford Univ. Press, Oxford.
9. Wischnizer S. (1989). *Introduction to Electron Microscopy*. Pergamon Press, New York.

Research papers / Reviews:

1. Aguzzi, A. et al. (2007) Molecular mechanisms of prion pathogenesis. *Ann. Rev. Path: Mech. Dis.* 3: 11-40.
2. Baluska F. et al. (2004) Eukaruotic cells and cell bodies: cell theory revised. *Ann. Bot.* 94:9-32
3. Boxma, B. et al. (2005) An anerobicmitochondtion that produces hydrogen. *Nature* 434:74-79.
4. Delwich CF (1999). Tracing the thread of plastid diversity through tapestry of life. *Amer.Nat.* 154:S164-177
5. Dobson CM (2005). Structural biology: prying the prions. *Nature* 435:747-749
6. Gruenbaum Y. et al. (2003). The nuclear lamina and its functions in the nucleus. *Int. Rev.Cytol.* 226:1-62
7. Meagher, B. et al. (1999). "The evolution of new structures: clues from plant cytoskeletalgenes. *TIG*, 15:7, 278-284.

8. Moerschbacher B. (2002). The plant cell wall - structural aspects and biotechnological developments. Pp. 445-477. In: Oksman-Caldentey, K-M. and Baz, W.H. Plant Biotechnology and Transgenic Plants. Marcel Dekker, Inc. New York.
9. Raven JA and Allen JF (2003). Genomics and chloroplast evolution: What did cyanobacteria do for plants? *Genome Biol.* 4(3): Art No. 209.
10. Rose A. et al. (2003). The plant nuclear envelope. *Planta.* 218:327-336.
11. Smith and Raikhel (1999). Protein targeting to the nuclear pore: what can learn from plants?" *Plant Physiol.* 119:1157-1163.
12. Van der Giezen et al.(2005) " Mitochondrion-derived organelles in protists and fungi". *Int. Rev. Cytol.* 244:175-225.
13. Vereb, G. et al. (2003) Dynamic, Yet structured: the cell membrane three decades after the singer-Nicolson model. *Proc. Nat. Acad. Sci. USA* 100: 8053-8058.
14. Wasteneys Go and Yang Z (2004) New views on plant cytoskeleton. *Plant Physiol.* 136: 3884-3891.

M.Sc (BOTANY)

IVTH SEMESTER

COURSE CODE: MBTD05

COURSE TYPE: CCC/CB

COURSE TITLE: PLANT PHYSIOLOGY AND BIOCHEMISTRY

CREDIT:6

HOURS:90

THEORY: 6

PRACTICAL:0

THEORY:90

PRACTICAL: 00

MARKS

THEORY: 100 (20+80)

PRACTICAL:00

OBJECTIVE : This course is aimed towards generating fundamental knowledge, concepts and dimensions of Botany/ Plant Science.

UNIT-1-
18 Hours

Stress physiology: Plant responses to abiotic stresses, mechanisms of abiotic stress tolerance, water deficit and drought tolerance, salinity stress, metal toxicity, freezing and heat stress.

Oxidative and nitrosative stress and antioxidative strategies: Nitrosative and oxidative stress - causes and effects, nitric oxide biosynthesis and metabolism, NO mediated signaling, markers of nitrosative stress, NO crosstalk with other hormones, antioxidant mechanisms.

UNIT-2-
18Hours

Secondary metabolites and their biotechnological aspects: Natural products (secondary metabolites), their range and ecophysiological functions. Overview of terpenoidal, alkaloidal, and phenolic metabolites and their biosynthesis. Molecular approaches and biotechnological applications.

Metabolic engineering in the production of pharmaceuticals.

UNIT-3-
18Hours

Physiology of seed development, maturation, dormancy and germination: Hormonal regulation of seed development, events associated with seed maturation, factors regulating seed dormancy, mechanisms of mobilization of food reserves during seed germination.

Fruit development and ripening: Stages of fruit development and their regulation, biochemical and related events during fruit ripening in climacteric and non-climacteric fruits, physiology and biochemistry of fruit abscission, post-harvest changes, production of transgenic fruits.

UNIT-4-
18Hours

Programmed cell death (PCD): Concept of PCD and its types in plants during vegetative and reproductive stages. Developmental and stress-induced PCD. Plant senescence and its characteristics. Leaf and flower senescence. Altered metabolism during senescence and its regulation. The oxidative stress and the anti-oxidative strategies. Hormonal modulations. Environmental, genetic and molecular regulations.

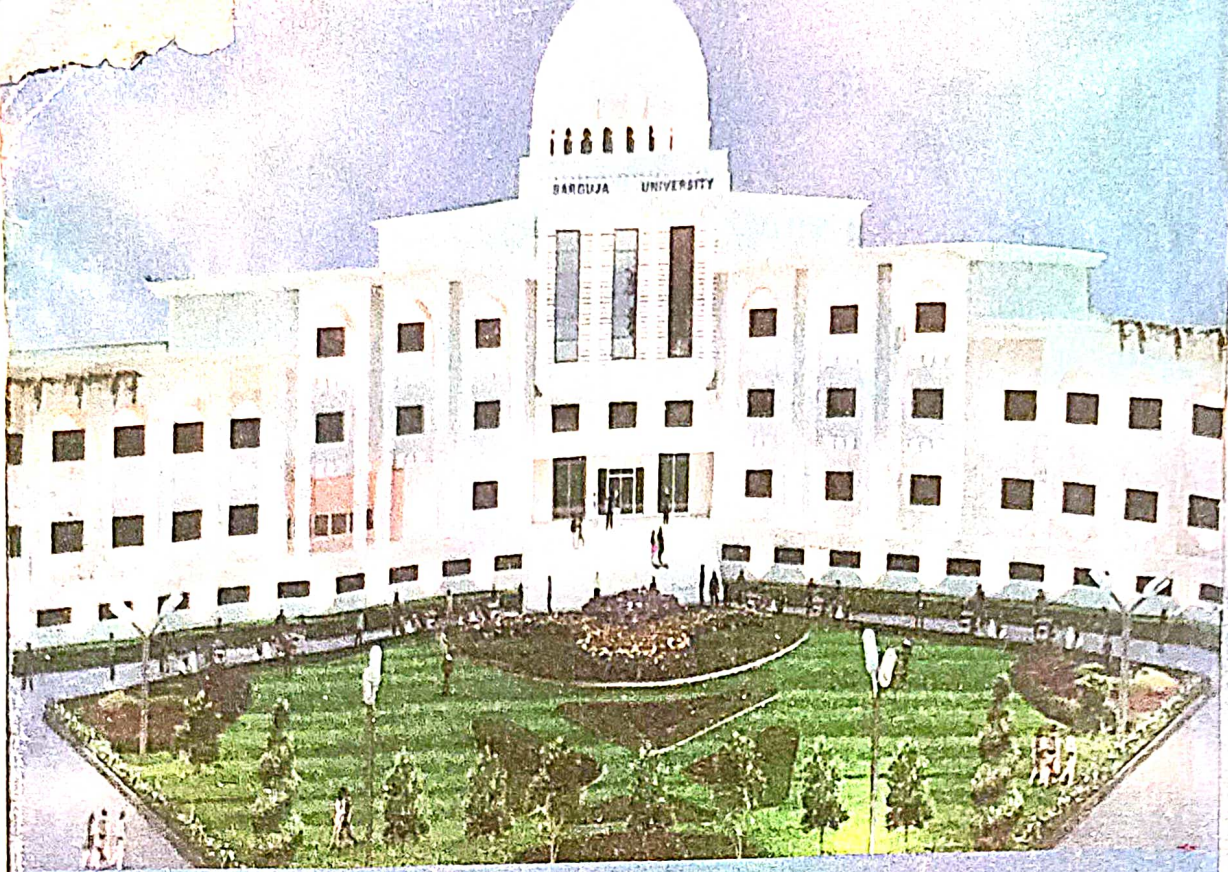
UNIT-5-
18 Hours

Sensory physiology: Biochemical and biophysical mechanisms of sense of touch, electric self- defence, taste, light, explosion, sleeping and rhythms. Stimuli that trigger rapid movements; movements based on mechanical forces; mobility triggered by sense of touch, taste and electricity; motors driving movements in the living world; actin-myosin motors; photosensing; chemistry of excitability; neurotransmitters in plants.

Chemical defence: Biochemical mechanisms of plants' chemical war against other plants and animals. Plant responses to herbivory; constitutive defence mechanisms; induced phytochemical responses; biochemical mechanisms of allelopathy.

SUGGESTED READINGS

Journals: Annual Review of Plant Biology, Critical Reviews in Plant Science, Current Opinion in Plant Biology, Trends in Plant Science.



प्रस्तावित संत गहिरा गुरु विश्वविद्यालय भवन एवं परिसर स्थल-ग्राम भकुसा

