M.Sc. Botany (CBCS)
Syllabus with effect from 2014 – 2015
REGULATIONS

MASTER’S PROGRAMME
   A Master’s programme consists of a set of Core courses and Optional courses.
   Core courses are basic courses required for each programme. The number and
distribution of credits for core courses will be decided by the respective faculties.
   Optional courses will be suggested by the respective departments, and they may be
distributed in all the four semesters.
   A course is divided into five units to enable the students to achieve modular and
progressive learning.

SEMESTERS
   An academic year is divided into two semesters, Odd semester and Even semester. The
normal semester periods are:
   Odd semester: July to November (90 working days)
   Even semester: December to April (90 working days)

CREDIT
   The term credit is used to describe the quantum of syllabus for various programmes in
terms of hours of study. It indicates differential weightage given according to the contents and
duration of the courses in the curriculum design. The minimum credit requirement for a two
year Master’s Programme shall be 90.

COURSES
   Each course may consists of lectures / tutorials / laboratory work / seminar / project
work / practical training / report / viva voce etc.,

COURSE WEIGHT
   Core and Optional courses may carry different weightage. For example, a course
carrying one credit for lectures, will have instruction of one period per week during the
semester, if three hours of lecture is necessary in each week for that course then 3 credits will
be the weightage. Thus normally, in each of the courses, credits will be assigned on the basis of
the lecture tutorials/laboratory work and other forms of learning in a 15 week schedule:
   i)  One credit for each lecture period per week.
   ii) One credit for each tutorial per week.
   iii) One credit for every three periods of laboratory or practical work per week
   iv) One credit for 3 contact hours of project work in a week.
   v)  One credit for every two periods of seminar.

GRADING SYSTEM
   The term Grading System indicates a 10 point scale of evaluation of the performance of
students in terms of marks, grade points, letter grade and class.
DURATION
The duration for completion of a two year Master’s Programme in any subject is four semesters.

STRUCTURE OF THE PROGRAMME
The Master’s Programme will consist of:

i) Core courses which are compulsory for all students.

ii) Optional courses which students can choose from amongst the courses offered by the other Department of a faculty as well as by the Departments of other faculties. (Arts, Science, Education and Indian Language)

iii) The Optional subjects will be allotted by counseling by a committee of the respective Heads of the Department under the Chairmanship of the Dean of the Faculty.

iv) Dissertation/Project work/Practical training/field work, which can be done in an organization (Government, Industry, Firm, Public Enterprise etc.) approved by the concerned department.

ATTENDANCE
Every teaching faculty handling a course shall be responsible for the maintenance of attendance register for candidates who have registered for the course.

The teacher of the course must intimate the Head of the Department at least Seven Calendar days before the last instruction day in the semester about the attendance particulars of all students.

Each student should earn 80% attendance in the courses of the particular semester failing which he or she will not be permitted to sit for the end-semester examination.

However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a Condonation fee and such exemptions should not under any circumstance be granted for attendance below 70%.

EXAMINATIONS
The internal assessment for each course carries 25% marks for theory and 40% marks for Practicals and is based on two sessional tests and a variety of assessment tools such as seminar and assignment. The pattern of question paper will be decided by the respective faculty. The tests are compulsory.

There will be one End Semester Examination (75% marks) of 3 hours duration for each course. The pattern of question paper will be decided by the respective faculty.

The internal assessment for Practicals carries 40% marks and is based on test, record, herbarium, field note and slide submission.

EVALUATION
The performance of a student in each course is evaluated in terms of Percentage of Marks (PM) with a provision for conversion to Grade Point (GP). The sum of the total performance in each semester will be rated by GPA while the continuous performance from the 2nd Semester onwards will be marked by OGPA.

MARKS AND GRADING
A student cannot repeat the assessment of Sessional test I and Sessional test II. However, if for any compulsive reason, the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department. A student has to secure 50% minimum in the End Semester Examination. The student who has not secured a minimum of 50% of marks (sessional plus end semester examination) in a paper shall be deemed to have failed in that paper.
A candidate who has secured a minimum of 50% marks in all the papers prescribed in the programme and earned a minimum of 90 credits will be considered to have passed the Master’s Programme.

**GRADING**

A ten point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master’s Programme.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Grade Point</th>
<th>Letter Grade</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>10</td>
<td>S</td>
<td>Exemplary</td>
</tr>
<tr>
<td>85-89</td>
<td>9.0</td>
<td>D++</td>
<td>Distinction</td>
</tr>
<tr>
<td>80-84</td>
<td>8.5</td>
<td>D+</td>
<td>&quot;</td>
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<tr>
<td>75-79</td>
<td>8.0</td>
<td>D</td>
<td>&quot;</td>
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<tr>
<td>70-74</td>
<td>7.5</td>
<td>A++</td>
<td>First Class</td>
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<tr>
<td>65-69</td>
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<td>&quot;</td>
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<tr>
<td>60-64</td>
<td>6.5</td>
<td>A</td>
<td>&quot;</td>
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<tr>
<td>55-59</td>
<td>6.0</td>
<td>B</td>
<td>Second Class</td>
</tr>
<tr>
<td>50-54</td>
<td>5.5</td>
<td>C</td>
<td>&quot;</td>
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<tr>
<td>49 or Less</td>
<td>F</td>
<td>F</td>
<td>Fail</td>
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</table>

The successful candidates are classified as follows: I Class-60% marks and above in Overall Percentage of Marks (OPM). II Class-50-59% marks in overall percentage of marks.

Candidates who obtain 75% and above but below 90% of Marks (OPM) shall be deemed to have passed the examination in FIRST CLASS (Distinction) provided he/she passes all the papers prescribed for the programme at the **First appearance**.

For the Internal Assessment Evaluation, the break up marks shall be as follows for **theory**:  
- Test (Two) --- 15 Marks  
- Assignment --- 5 Marks  
- Seminar --- 5 Marks  
**Total 25 Marks**

For the Internal Assessment Evaluation, the break up marks shall be as follows for **practical**:  
- Test (Two)- 10+10 --- 20 marks  
- Record --- 10 marks  
- Herbarium/ Slide --- 10 marks  
**Total 40 Marks**

The M.Sc., students of Botany shall undertake a Botanical Tour during third semester under the guidance of the staff members for field training and plant collection.

**COURSE-WISE LETTER GRADES**

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than F. A letter grade F in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade point. The F grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the odd/even semester in which the candidate has appeared for clearance of the arrears. A student who secures F grade
in any course which is listed as a core course has to repeat it compulsorily when the examination is held next. If it is an optional course, the student has the option to repeat it when it is offered next or to choose a new optional if he/she so desires in order to get a successful grade. When new optional is chosen in the place of failed optional, the failed optional will be indicated as dropped in the subsequent grade card. If a student secures F grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit it, if it involves only rewriting incorporating the clarifications of the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.
# M.Sc. BOTANY

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**SCHEME OF EXAMINATION AND SYLLABUS**

Total Credits: 90

## FIRST SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE</th>
<th>L</th>
<th>P</th>
<th>C</th>
<th>Int. Asse. Marks</th>
<th>End Sem. Exam Marks</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>BOTC 101</td>
<td>Plant Diversity - I</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
<td>100</td>
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<tr>
<td>BOTC 102</td>
<td>Mycology, Microbiology and Plant Pathology</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
<td>100</td>
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<tr>
<td>BOTC 103</td>
<td>Biological Techniques and Instrumentation</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>25</td>
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<tr>
<td>BOTP 104</td>
<td>Practical covering BOTC101,102 &amp; 103</td>
<td>0</td>
<td>9</td>
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## SECOND SEMESTER

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<th>End Sem. Exam Marks</th>
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<tbody>
<tr>
<td>BOTC 201</td>
<td>Plant Diversity - II</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
<td>100</td>
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<tr>
<td>BOTC 202</td>
<td>Plant Anatomy, Embryology and Morphogenesis</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
<td>100</td>
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<tr>
<td>BOTC 203</td>
<td>Genetics and Plant Breeding</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
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<tr>
<td>BOTP 204</td>
<td>Practical covering BOTC201,202 &amp; 203</td>
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<td>9</td>
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<tr>
<td>Soft Skill Development &amp; Optional I</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>25</td>
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### THIRD SEMESTER

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<tr>
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<td>Taxonomy of Angiosperms and Economic Botany</td>
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<td>BOTC 303</td>
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<td>BOTC 304</td>
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<td></td>
<td>Optional II</td>
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### FOURTH SEMESTER

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<th>Int. Asse. Marks</th>
<th>End Sem. Exam Marks</th>
<th>Total Marks</th>
</tr>
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<tbody>
<tr>
<td>BOT C 401</td>
<td>Plant Physiology</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>BOT C 402</td>
<td>Environmental Biology</td>
<td>5</td>
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<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>BOT P 403</td>
<td>Practical covering BOTC 401 &amp; 402</td>
<td>0</td>
<td>9</td>
<td>3</td>
<td>40</td>
<td>60</td>
<td>100</td>
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<tr>
<td>BOT 404 A (or) 404 B</td>
<td>Optional III Applied Botany (or) Enzyme Technology</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>25</td>
<td>75</td>
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<tr>
<td>BOT 405 A (or) 405 B</td>
<td>Optional IV Horticulture and Landscaping (or) Bio prospecting of Medicinal and Aromatic plants</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>9</td>
<td>21</td>
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</tbody>
</table>
Objectives:
1. To acquire knowledge of the algal flora in land, fresh water and marine environment.
2. To understand the structure, reproduction and life cycle of algae.
3. To appreciate the uses of algae as food, fodder and pharmaceuticals.
4. To study the character of thalloid and leafy liverworts and mosses.
5. To acquire knowledge about structure and reproduction of Lichens.

PHYCOLOGY

Unit – I

Classification, range of structure, reproduction; evolutionary trends; fossil history, economic importance, ecology and phylogeny in Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae and. Cyanophyceae,

Unit – II


BRYOLOGY

Unit- III


Unit- IV

Gametophyte and sporophyte of thalloid liverworts, Gametophyte and sporophyte of leafy liverworts, Asexual and sexual reproduction in Bryophytes, Gametophyte and sporophyte of Mosses

LICHENOLOGY

Unit – V

General account of structure and life cycle of Lichens-broad outline classification. Structure, reproduction and lifecycle of the following types: a) Parmelia; b) Usnea. Ecological role and economic importance of lichens.

Practicals:
Phycology

Batrochospermum, Polysiphonia, Gracilaria, Microcystis, Nostoc, Stigonema, Anabaena, Lyngbya, Scytonema and Spirulina.

Bryology

Riccia, Targionia, Reboulia, Dumortiera, Pallavicinia, Riccardia, Porella, Sphagnum and Bryum.

Lichenology

Collection and identification of lichen specimens and make labelled sketches of specimens. Study the external and internal structures of the types mentioned.

Books


BOTC – 102 - MYCOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY

Objectives:
1. To study the classification, structure and reproductive features of fungi, bacteria and viruses.
2. To develop skill in isolation and purification of microbes.
3. To understand the morphology and genetics of microbes and their uses.
4. To have knowledge of the causative organism, etiology, symptoms and control of various plant diseases.
5. To understand the host-parasite interactions and the role of enzymes and toxins in pathogenesis.

MYCOLOGY

Unit – I
Introduction to Fungi, Position of Fungi among living organisms – criteria and evidences - Recent trends in the classification of Fungi with special reference to Alexopoulos and Mims. Structure, Nutrition of fungi
Myxomycotina : Fuligo, Physarum.
Eumycotina : Olpidium.
Mastigomycotina : Phytophthora, Perenospora
Plasmodiophoromycetes : Plasmodiophora.
Zygomycotina : Pilobolus.
Unit – II
Classification and diversity of Fungi Ascomycotina: *Aspergillus, Xylaria, Claviceps, Peziza, Morchella.*
Basidiomycotina: *Lycoperdon, Ustilago, Polyporus.*
Deuteromycotina: *Alternaria, Fusarium*
Spore dispersal and factors affecting spore germination, reproduction, life history, phylogeny and affinities of the major groups of Fungi.
Heterothallism, Parasexual cycle, Degeneration of sexuality.
Economic importance, Fungi as bio-control agents.

MICROBIOLOGY
Unit – III

Unit – IV

PLANT PATHOLOGY
Unit – V
Etiology, Symptoms, Causative agents and Control of the following diseases: Tobacco Mosaic, Bunchy top of Banana, Leaf spot in Cotton, Blight of Paddy, Citrus canker, Soft rot in vegetables, Little leaf of Brinjal; Blast of Paddy, Red rot of Sugar cane, Tikka disease of ground nut and Damping off of seedlings. Plant disease management - Principles and methods of disease control – Chemical, Biological and Agronomical Practices – Modeling and disease forecasting- Legislation and quarantine practices in India.

Practicals:
Mycolgy
Structure, reproduction and diagnostic features of *Phytophthora, Peronospora, Pilobolus, Saccharomyces, Aspergillus, Xylaria, Claviceps, Peziza, Morchella, Lycoperdon, Ustilago, Polyporus, Alternaria, Fusarium* 

Microbiology
Plant Pathology
Verification of Koch’s postulates. Identification of plant diseases included in theory syllabus.

Books:
8. Raina M. Maier; Lan L. Pepper; Charles J.P. Gerba 2009; Environmental Microbiology; Elsevier Ap Academic press
10. Robert Burns; 2010; Plant Pathology -Techniques and Protocols; Springer – Humana press

BOTC – 103 - BIOLOGICAL TECHNIQUES AND INSTRUMENTATION

Objectives:
1. To know the principles of various biological techniques and their applications
2. To understand the basic application and working principles of various equipments in Biological Sciences.

Unit – I


Unit – II


Unit III

Principles and applications of pH meter and Conductivity meter. Centrifugation – Density gradient and ultra centrifugation.
Unit-IV
Calorimeter-Principles and Applications – Spectrophotometry –UV-visible –Infrared-
Atomic absorption Spectrophotometer – Chromatography – Paper, TLC, Column and Affinity.
Radio Isotopes-Types of Radio activity- Gieger-Muller counter- Scintillation counters –
Autoradiography.

Unit – V
Electrophoresis – General principles –SDS- PAGE– Agarose gel.
Blotting techniques- Southern, Northern and Western.
ELISA, RIA, Polymerase Chain Reaction, RAPD, RFLP, SSR, DNA finger printing and
FISH techniques

Practicals:
Biological techniques
1. Principles, identification and components of Light, Polarizing, TEM, SEM, ELISA and PCR
2. Fixing, Embedding and Sectioning with microtome
3. Single and Double stained slide preparation with hand and microtome sections
4. Measurement of soil pH
5. Measurement of electrical conductivity
6. Electrophoretic separation of proteins by SDS-PAGE
7. Separation of DNA with Agarose gel
8. RAPD

Books:
1. Albert Schneider.2012. Microscopy and Microtechnique. Rare book club.com, United
   States, New York.
   Germany.
   publishers, Chennai.
    London, UK.
    Bangalore.
II – SEMESTER  
BOTC 201- PLANT DIVERSITY - II

Objectives
1. To acquire knowledge on living and Fossils forms of Pteridophytes and Gymnosperms.
2. To understand the reproductive feature of Pteridophytes and Gymnosperms.
3. To apply the knowledge on fossil and fossilization.

PTERIDOLOGY

Unit – I

Gametophytes in Pteridophytes,– sex organs. Apogamy and Apospory

Unit – II

Stelar evolution and soral evolution in Pteridophytes and Phylogeny. Heterospory and seed habit, ecology and ecological indicators and economic importance of Pteridophytes.

GYMNOSPERMS

Unit – III
Classification of Gymnosperms (Sporne,1965). A general account of distribution, morphology, anatomy, reproduction, phylogeny and relationship of the following orders with special reference to the genera mentioned against each order.

Cycadopsida
1. Pteridospermales
   Lyginopteridaceae : Lyginopteris, Heterangium, Lagenostoma, Physostoma.
   Medullosaceae : Medullosa, Trignocarpus
Glossopteridaceae : Glossopteris
Caytoniaceae : Caytonia.
2. Bennettitales
   Cycadeoidaceae : Cycadeoidea.
3. Pentoxylales
   Pentoxylaceae : Pentoxylon
4. Cycadales
   Cycadaceae : Zamia

UNIT – IV
Coniferopsida
1. Cordaitales.
   Cordaitaceae : Cordaites.
2. Coniferales.
   Cupressaceae : Cupressus
   Podocarpaceae : Podocarpus.
   Araucariaceae : Araucaria
3. Taxales
   Taxaceae : Taxus.
4. Ginkgoales
   Ginkgoaceae : Ginkgo

Gnetopsida
   Ephedraceae : Ephedra


PALAEOBOTANY

UNIT – V

Practicals :
   Pteridology
   Fossil forms: Rhynia, Horneophyton, Asteroxylon Lepidodendron, Lepidocarpon, Sphenophyllum and Calamites.
   Living forms: Ophioglossum, Angiopteris, Osmunda, Dicranopteris, Alsophila, Adiantum, Pteris, Marsilea, Salvinia and Azolla.

Gymnosperms
   Identification and characteristic features of Lyginopteris, Heterangium, Lagenostoma, Physostoma, Trignocarpus, Zamia, Cupressus, Podocarpus, Araucaria, Ginkgo, and Ephedra.

Paleobotany
   Compression, Impression and Petrified Fossils

Books
OBJECTIVES:
1. To acquire the knowledge on internal structure of plants.
2. To understand the fertilization and development of Embryo.
3. To apply knowledge on cell enlargement and differentiation.

PLANT ANATOMY

Unit – I


Unit – II

Leaf Anatomy – Types of stomata and Stomatal index. Anatomy of floral parts, Anatomy of Fruit wall and Seed Coat.

EMBRYOLOGY

Unit - III

Pollen – pistil interactions and fertilization : barriers of fertilization, control of fertilization and current concept of fertilization – self incompatibility – methods to over come self incompatibility - Experimental Embryology including pollen storage and test tube fertilization.
Endosperm : classification and types, haustoria - functioning of storage metabolites
Embryo – development of dicot and monocot embryo –nutrition of embryo

Unit - IV

Polyembryony : classification and types
Apomixis : diplospory , apospory, parthenogenesis and parthenocarpy : practical applications of apomixis and polyembryony.
Embryology and Taxonomy – embryological features of taxonomical importance.
Shoot, root and leaf development and phyllotaxy; Transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum

MORPHOGENESIS

Unit - V

Morphogenesis : Basic concepts and its importance. Morphogenetic factors –extra cellular matrix and cell membrane- their role in morphogenesis.
Cell differentiation and its mechanism – nucleo-cytoplasmic interactions .
Internal morphology: Classical concept of flower, conduplicate carpel theory, floral vascularization – inferior ovary and carpel polymorphism
Practicals:
Plant Anatomy:
Examination of Root and Shoot apices; Maceration, clearing and peeling techniques; cambial variant in Bougainvillaea, Boerhaavia, Nyctanthes, Bignonia, Aristolochia, Strychnos and Dracaena. Nodal Anatomy – Different types of nodes. Different types of stomata - Calculation of stomatal index and frequency.
Fruit wall and Floral vascular Distribution.

Embryology
Different stages of anther, embryo sac, endosperm and embryo development
Pollen germination and viability test
Dissection of embryo – Tridax, Crotalaria and Cleome
Endosperm and endosperm haustoria – Cucurbitaceae members

Morphogenesis
Wounding of young stem and study of the wound healing response
Effect of removal of leaf primordial and axillary buds
Study of T.S. of Receptacle, Sepal, Petal, Stamen of Carpel traces and Inferior ovary.

Books:
8. Sharma H.P; 2009; Plant Embryology; Narosha Publishers, New Delhi

BOTC 203 - GENETICS AND PLANT BREEDING

Objectives:
1. To acquire the knowledge in Heredity and variation.
2. To understand the fundamental and molecular basis of gene action.
3. To develop skill on different methods and techniques in plant breeding.

GENETICS
Unit – I
Sex determination in plants and sex linked inheritance, Chromosome mapping –Reverse genetics and epigenetics and their biological importance.
Unit – II

Extra-nuclear inheritance: cytoplasmic inheritance – chloroplast and Mitochondrial genome in higher plants.

Unit – III


PLANT BREEDING

Unit - IV

Introduction- Floral biology: significance – floral biology of crop plants in relation to their breeding systems.
Importance of male sterility and haploid plants in Plant breeding- Heterosis.
Breeding methods: Methods of Plant breeding in self and cross pollinated crops.
Centre of origin of cultivated plants – Role of plant domestication, Introduction and acclimatization in plant breeding.
National and International organizations for crop improvement.

Unit – V

Selection in segregating populations – Pedigree method, bulk method and back cross method
Plant Hybridization – Types and process of Hybridization
Modern methods of Plant breeding- Mutation breeding, Polyploidy breeding and Distant hybridization.
Role of Biotechnology in Plant breeding.

Practicals:
Genetics
1. Genetics problems in Mendelian inheritance, gene interaction, quantitative inheritance , multiple alleles, sex linkage and genetic maps

Plant Breeding
1. Methods of vegetative propagation – Layering, Budding and Grafting
2. Techniques in selfing and hybridization

Books:
18

III - SEMESTER

BOTC - 301 - TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Objectives
1. To acquire knowledge in naming of plants.
2. To understand the method of plant classification
3. To apply the knowledge in biosystematics
4. To develop skill to enumerate the family characters.
5. To appreciate the economic potential of plants.

TAXONOMY OF ANGIOSPERMS

Unit – I

Essentials of Taxonomy, Historical account on classification of angiosperms- A detailed account of the systems of classification of Linnaeus, Bentham and Hooker, Engler and Prantl and a general account on the system of classification of Takhtajan. Chemotaxonomy and Numerical taxonomy.

Nomenclature and taxonomical techniques. Plant Nomenclature – Brief History on the origin and development of nomenclature; Detailed study of the major provisions of the International Code of Botanical Nomenclature (ICBN) – Effective and valid publications, Role of priority and its limitation, typification, Different kinds of types, Author citation and rejection and retention of names, conserved names.

Unit- II:

APG System and its significant-Different kinds of identification keys, Construction of dichotomous keys- Indented and bracketed keys. Various kinds of Taxonomic literature: Floras, Revisions, Manuals – Monographs, Periodicals. Computational Taxonomy, Information systems- data banking and use of computers in Taxonomy, computer constructed keys. Uses of molecular tools in Taxonomy, RFLP, RAPD and AFLP. Methods of Plant exploration; Management of Herbaria; Major Herbaria in India and the World; Role of Herbaria in
Taxonomy. Botanical Survey of India. Conservation of Biological Diversity (In situ and Ex situ)

Unit – III
A detailed study of the following families with their interrelationship and phylogeny
- Annonaceae
- Portulacaceae
- Sterculiaceae
- Zygophyllaceae
- Rhamnaceae
- Sapindaceae
- Fabaceae
- Combretaceae
- Myrtaceae
- Lythraceae
- Passifloraceae
- Cucurbitaceae
- Apiaceae

Unit – IV
A detailed study of the following families with their interrelationship and phylogeny
- Rubiaceae
- Apocyanaceae
- Gentianaceae
- Boraginaceae
- Scrophulariaceae
- Acanthaceae
- Lamiaceae
- Nyctaginaceae
- Verbenaceae
- Euphorbiaceae
- Casuarinaceae
- Liliaceae
- Poaceae

ECONOMIC BOTANY

Unit – V
A brief account of Botany, cultivation and utilization of Cereals, pulses, nuts, vegetables and fruits
- Spices and condiments
- Fats and oils-essential oils
- Commercial crops- Wheat, Cotton and Sugarcane, fibres, timbers
- Tannins, resins, alkaloids
- Drug yielding plants
- Plants as a source of renewable energy – Ethnobotany and its importance.

Practicals:
Taxonomy of Angiosperm
Detailed study of the families mentioned in the theory with two representative species from the local area.
Familiarity of the binomial nomenclature of the available species from the local flora using Gamble’s flora.
Solving the taxonomical problems

Economic Botany
Identification of family, genus, species and morphology of the useful parts of plants mentioned in the theory.

Books

**BOTC - 302 - CELL BIOLOGY AND MOLECULAR BIOLOGY**

**Objectives:**
1. To acquire the knowledge of fundamental unit of living being.
2. To understand the different types of cells and cell organelles.
3. To apply the knowledge in structure and function of gene at molecular level.
4. To develop skill on different methods of Molecular Biology.

**CELL BIOLOGY**

**Unit – I**

Structural organization and functions of intracellular organelles: Cell Wall, Nucleus, Mitochondria, Golgi body, Lysosome, Endoplasmic reticulum, Ribosome, Peroxisome, Plasmid, Vacuole, Chloroplast, structure & function of Cytoskeleton and its role in motility.

Cell Membrane, Structure and Membrane Transport.


**Unit – II**

Cell division: Types of cell divisions, Events of cell division, Differences between Mitosis and Meiosis - Molecular basis of cell cycle.

Synopsis, Synaptinemal complex, Mechanism of crossing over and formation of Chiasma.

Chromosomes: Types, Fine structure of eukaryotic chromosome – Kinetochoore, chromomeres, satellite, Euchromatin and Heterochromatin- special types of chromosomes - Chromosome banding and chromosome painting.

Chromosomal variation and aberration, Karyotype analysis
MOLECULAR BIOLOGY

Unit – III


Unit - IV


Unit – V

Coupled transcription - Translation - Translation and post-translational modifications in Eukaryotes-Protein folding.

Practicals:
Cell Biology
1. Squash and smear techniques
2. Study of cell division – Mitosis (Allium cepa, Rhoeo, Urgenia, Scilla)
3. Study of Meiosis - (Allium cepa, Helianthus, Tredescantia flower buds)
4. Study of chromosomal aberrations and polyploidy
5. Karyotype analysis – Idiogram preparation
6. Study of special types of chromosomes

Molecular Biology
1. Isolation of high molecular weight genomic DNA from rice
2. Isolation of DNA from tender coconut
3. Separation of plant genomic DNA by electrophoresis
4. Qualification of Plant Genomic DNA by Spectrophotometric method
5. Quality checking of DNA by Electrophoresis
6. RAPD Techniques
7. Isolation of plasmid DNA
8. Southern blotting (Demonstration)
9. Western blot - detection of proteins (Demonstration)
Books:

BOTC - 303 - BIOTECHNOLOGY , GENETIC ENGINEERING AND TISSUE CULTURE

Objectives
1. To understand and acquire the knowledge of Bio-technological innovative methods and products
2. To acquire basic knowledge on Plant Genomics
3. To understand the basic knowledge on Patent rights
4. To acquire knowledge about the various aspects of tissue culture and their importance.

BIOTECHNOLOGY
Unit – 1
Unit – II


GENETIC ENGINEERING

Unit – III


Unit – IV


TISSUE CULTURE

Unit – V


Practicals:
1. Isolation of single cell protein
2. Immobilization of yeast cells
3. Analysis of digest from cellulose
4. PCR – Technique with known primers
5. Bio control of plant insects using *Bacillus thuringiensis*
6. Bio control of plant insects using PHV.
7. Preparation of explants
8. Establishment and maintenance of Carrot callus
9. Initiation and establishment of cell suspension culture of carrot
10. Embryogenesis in cultured cells of carrot
11. Microspore culture- preparation of artificial seeds
**Books:**

**BOTC - 304 - RESEARCH METHODOLOGY, BIO-INFORMATICS AND NANOTECHNOLOGY**

**Objectives:**
1. To acquire basic knowledge on Research methodology and computer application
2. To acquire basic knowledge on Bio-informatics and Nanotechnology
3. To understand the basic applications of hardware and softwares of computer
4. To develop skill in Internet usage.

**RESEARCH METHODOLOGY**

**Unit – I**

Scientific writing – Characteristics, Logical format for writing thesis and papers
Essential features of abstracts - components of thesis writing-
Introduction –Review of literature – Primary, secondary references
Materials and methods- Effective illustration- Tables and figures- Discussions, Reference styles – Harvard and Van couver system

**Unit – II**

Computer in Biological science, scope and prospects.
Operation system – Definition- Classification-Input and output devices.
Introduction to windows operating system- MS windows – MS-Word-folders, files, MS Excel – MS Power point - creating slides – templates – animation and transitions - Data storage –
Data analysis - On line publications: Electronic journals - Internet-World Wide Web-Search engines – their functions- Email-e-access data base concepts and implication.
Biostatistics packages- Data base preparation- Graphic applications in Biology.
BIOINFORMATICS

Unit – III

Introduction and scope of bioinformatics- Boolean searching – file formats-
Biological Databases – Nucleic acid , protein sequence and structure data bases- data retrieval -
web based tools for sequence searches – sequence similarity searches – FASTA and BLAST,
Clustral and Phylip –Motif analysis and presentation.

NANOTECHNOLOGY

Unit – IV

Introduction, Basic principles, tools and techniques, nanobioelectronic devices and
Polymer nano containers, Microbial production of inorganic nano particles, Role of Computers
in Nanotechnology. DNA based nanostructures- Topographic and electrostatic properties of
DNA and proteins – Hybrid conjugates of gold nano particles – DNA Oligomers metal nano
particles and nucleic acid and protein based recognition groups- nano particles as carrier for
 genetic materials – Applications of nanotechnology in medicine and agriculture.

Unit – V

IPR Patents - Patent procedures - Infringement problems – Patenting information
systems and services in India - Trade secrets - Copy rights and Trade marks - Patenting
biological materials - Higher plants, transgenic organisms, isolated genes and DNA
sequences- biotechnological innovations.
IPR for Plant breeding: Plant variety protection - Plant breeder’s rights - Farmer’s rights -
WTO – GATT, conventions and treaty on patent and trade, TRIPS.
Bioethics – Biosafety regulations, IBSC, Good Laboratory practices.

Practicals:
1. Acquiring of basic skills in Internet browsing
2. Familiarization of web browsers and search engines
3. Familiarisation of important biological and bioinformatics web sites
4. Write an algorithm to find sequence similarity search using BLAST
5. Write an algorithm to determine protein structure using protein databases.

Books:
Biomedical Applications, Techniques, Tools, Applications and Impact. Willey – VCH.
IV- SEMESTER
BOTC – 401 - PLANT PHYSIOLOGY

Objectives:
1. To acquire the knowledge about the metabolism in plants
2. To understand the biophysical and biochemical processes
3. To understand the role of growth regulators on growth and development of plants
4. To understand the plant adaptation to various environmental conditions

Unit – I


Unit – II


Unit – III


Unit – IV


Unit – V

Responses of Plants to Biotic (Pathogen and insects) and Abiotic stress (Water deficit and flooding, Temperature - high and low, chilling and freezing, salinity and alkalinity): Mechanism of tolerance to various stresses – significance of water use efficiency, importance of osmoregulation, stress responsive proteins - Role of antioxidative mechanism in stress tolerance.
Practicals:
1. Determination of osmotic potential by plasmolytic method.
2. Determination of water potential using gravimetric method.
3. Determination of water potential using dye method (Chardakov’s method).
4. Effect of Monochromatic light on apparent photosynthesis.
5. Effect of CO\textsubscript{2} concentration on apparent photosynthesis.
7. Separation of chloroplast pigments using paper chromatographic technique.
8. Estimation of chlorophyll content using Arnon’s method.
9. Determination of rate of photosynthesis using O\textsubscript{2} electrode.
10. Experiment to study the rate of Hill activity of isolated chloroplast by dye-reduction.
12. Effect of Auxin on root initiation
13. Experiments to show the herbicidal action of Auxin (2-4D).
15. Estimation of Proline content
16. Estimation of Glycinebetaine content
17. Determination of Relative Water Content

Books
BOTC – 402 - ENVIRONMENTAL BIOLOGY

Objectives:
1. To acquire knowledge on the components of environment.
2. To understand the different type of ecosystem.
3. To apply the knowledge in control of pollution.
4. To understand Biodiversity and its conservation.
5. To study about the various aspects of Conservation Biology.

Unit – I

Unit - II

Causes, effects and control of Green house effect, Ozone layer depletion and Acid rain - Energy crisis- its dimensions and management.

Unit - III
Biodiversity: Concepts, types measures and distribution of diversity, Major Biomes of the World – Biogeographical zones of India- Vegetational types.
Economic values of Biodiversity, Loss of biodiversity. Endemism, Hotspots, Red Data Book, Threatened plants and animals of India.

Unit - IV

Unit - V
Principles of Conservation: Conservation of Natural Resources. National and International conservation agencies (UNEP, MAB, WWF, CITES, RAMSAR and Biodiversity convention), Conservation strategy in India (Project Tiger; Biodiversity Heritage sites, Biosphere Reserves) Biodiversity act - 2002.

Practicals:-
Methods of studying vegetation
1. Quadrat method: List quadrat, count-quadrat, minimum size of the quadrat for a given vegetation.
2. Transect method: Line transect, belt transect and bisect method. Relative frequency, relative density and relative dominance. Important value index and polygraph charting.

Pollution studies
Effect of industrial effluents on seed germination, - Estimation of dust pollution on plants. - Ecological Instruments- Ecological adaptation of plants.
Water analysis
Estimation of EC, pH, turbidity and TDS.
Estimation of Sulphate and Nitrate
Analysis of Na, K, Ca and Cl in pond water

Soil analysis
Estimation of EC, pH
Soil moisture content
Soil N, P, K, turbidity and TDS

Books
17. Prithipalsingh, 2007; An Introduction to Biodiversity; Anes book India – Chennai

BOT 404 A- APPLIED BOTANY

Objectives:
1. To understand the Post harvest technology of fruits
2. To study about the principles of seed storage
3. To acquire knowledge on seed certification.

Unit – I:
Classification of fruits – Temperate and subtropical production – varieties, climate and soil requirements – propagation, planting density and cropping system- training and pruning – uses of growth regulators and nutrients to improve production. Weed management – pests, disease and their control – harvesting, post harvesting handling and storage – Marketing and export of the following.
- Citrus, Banana, Guava, Mango, Grapes, Papaya, pineapple and Tamarind.

Unit – II:
Rose, Jasmine, Crossandra, Marigold, Dhalia and Anthurium, Micropropagation of orchids- Shadenet and green house cultivation.
Unit – III:

Unit – IV:
Seed production in self and cross pollinated crops. Classes of seed: Nucleus, breeder, foundation and certified seeds - Seed harvesting, seed processing, seed treatments, seed testing and seed sampling. Viability and vigour - Seed borne pathogens - Seed certification, standard inspection, legislation and seed law-enforcement.

Unit – V:
Introduction: production of fruits- quality losses of fruits, Determination of harvest maturity and handling methods - Factors affecting fruits during storage, package design, packaging types.

Practicals:
1. Analysis of seed purity
2. Determination of seed moisture
3. Germination Test
4. Tetrazolium test for seed viability
5. Determination of seed vigour
6. Study of starch degradation during ripening of fruits
7. Effect of storage moisture on seed viability
8. Effect of storage temperature on seed viability

References:

BOT 404 B- ENZYME TECHNOLOGY

Objectives:
1. To acquire the knowledge of nomenclature, classification, properties of enzymes and mechanism of action.
2. To understand the methods of isolation and purification of enzymes
3. To understand the various methods of immobilization and its application
4. To know about the enzymes of industrial and clinical significance.
5. To study about the enzymes in salinity tolerance and in Food Industry

Unit – I
Enzymes: Biological catalysts – Nomenclature and classification; properties of enzymes – Isoenzymes, enzyme co-factors and activators, factors affecting enzyme activity; Mechanism of enzyme action (Kinetics of enzymatic catalysis); enzyme inhibition; Co-enzymes; Regulation of enzyme activity; Non-protein enzymes- Ribozymes and DNA enzymes.

Unit – II
Isolation and Purification of enzymes: Biological sources for enzymes production; Location of enzymes; Extraction of enzymes; Purification by differential solubility, Chromatographic methods, Electrophoresis and Ultracentrifugation; Bio safety in Industrial isolation and purification of enzymes.
Unit – III

**Immobilised Enzymes:** Advantages of using immobilised enzymes; Methods of Immobilization: Adsorption, Entrapping, ionic bonding, cross linking and encapsulation. Effect of enzyme immobilization on enzyme stability, Applications of immobilized Enzymes.

Unit – IV

**Industrial Enzymology:** Enzymes of Industrial and clinical significance, sources of Industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, peptic enzymes, lipases.

Unit – V

**Enzymes biotechnology:** Enzymes in salinity tolerance, New strategies for target identification, validation and use of enzymes in high-throughput screening; use of genomics for enzyme-based drug discovery; assigning precise function to genes; redesigning binding and catalytic specificities of enzymes;

**Practicals**

1. Estimation of protein by Lowry *et al.*
2. SDS – PAGE of Proteins
3. Estimation of α - amylase and β amylase
4. Determination of optimum pH and temperature for any two enzymes
5. Isolation and purification of any two enzymes
6. Estimation of proline oxidase
7. Estimation of Super Oxide Dismutase

**References and Textbooks**


**BOT 405 A- HORTICULTURE AND LANDSCAPING**

**Objectives**

1. To acquire knowledge on structure and construction of garden
2. To understand the diseases and control measures in Horticultural crops
3. To acquire knowledge on cultivation of fruit and flowering crops

**Unit – I**


Unit – II

Unit – III
Use of plant growth regulators in horticulture
Manures and Manuring – Training and Pruning – Irrigation techniques
Fungal and bacterial disease management in tropical and subtropical fruit crops
Some important diseases of Horticultural Plants and plant protection.

Unit – IV
Fruit culture : Mango – Guava – Banana – Papaya, Jack fruit, Limes and Lemons.
Culture of Economically important flowers: Jasmine – Chrysanthemum - Rose – Cut flowers.

Unit – V

Books:-

BOT 405 B- BIO PROSPECTING OF MEDICINAL AND AROMATIC PLANTS
Objectives:
1. To acquire knowledge on medicinal and aromatic plants
2. To understand antioxidant metabolism
3. To study about post harvest technology in medicinal plants

Unit – I:
Medicinal and Aromatic Plants – Importance and Scope – Classification of medicinal plants – based on morphology of useful parts, habit, taxonomical, pharmacological, chemical and Ayurvedic formulations – Cultivation of medicinal and aromatic plants – History of herbal medicine- Contribution of the Egyptians, Chinese, Greeks, Arabs and Indians -Different systems of herbal medicine: Ayurveda, Siddha and Unani.

Unit – II:

Unit – III:
General properties of Alcohols, Aldehyde, Glutaraldehyde, Halogens, Phenols, Gases, Surface active agents and Metallic salts ; Secondary Metabolites - Classification, General characters, Chemical nature, Extraction and Estimation methods for Alkaloids, Flavanoids,
Terpenoids and Phenolic compounds - Separation, Identification and Characterization of the potential bioactive compounds using UV, FTIR, $^1$H NMR, $^{13}$C NMR, 2D NMR, GC-MS and XRD. Bioactive molecules – Antibacterial, Antifungal, Antiplasmodial, Larvicidal and Antiviral drugs – mode of its action.

**Unit – IV:**

**Unit – V:**
Post-harvest technology in medicinal plants: scope and importance. Processing and utilization – Storage of crude drugs, Adulteration with reference to plant drugs, types of adulterants and methods of adulteration, Identification of adulterants. - Importance of herbal marketing -Future prospects and constraints of the herbal drug industry - Regulatory status of herbal medicine in India.

**References:**

**Optional papers for Inter Departmental Students**
**BOT O 215/315- PLANT TISSUE CULTURE**

**Objectives:**
1. To acquire knowledge in recent developments in Plant Tissue Culture
2. To understand the concepts in plant propagation.
3. To study about production of secondary metabolites

**UNIT – I**
Plant cell – Totipotency – Culture of plant cells, tissue and organs. Organization of Plant tissue culture laboratory – Aseptic techniques. Culture media – Nutritional components.

**UNIT – II**
UNIT – III
UNIT – IV
Anther and pollen culture – Somaclonal variation – Screening and Production of tolerant plants for various stresses.
UNIT – V
Production of secondary metabolites and single cell proteins by cell culture – Artificial seed, Rapid propagation Case studies on Tissue Culture in conservation of endangered plants – Banana – Rose and orchids. Tissue culture as a tool for Bio- technology.

Books:

BOT O 215/315- GARDENING AND HORTICULTURE

Objectives
1. To acquire knowledge on structure and construction of garden
2. To understand the diseases and control measures in Horticultural crops
3. To acquire knowledge on cultivation of fruit and flowering crops

Unit – I-

Unit- II

Unit – III
Manures and Manuring – Training and Pruning – Irrigation techniques.
Use of plant growth regulators in horticulture – Some important diseases of Horticultural Plants and plant protection.

Unit – IV – Pomology and Floriculture
Fruit culture : Mango – Guava – Banana - Papaya.
Culture of Economically important flowers : Jasmine – Rose – Cut flowers.

Unit – V - Post Harvest Technology – Storage and Transport
Books:

BOT O 215/315 - PLANT SCIENCE – I

Objectives:
1. To acquire basic knowledge in Plant Science
2. To impart knowledge in classical and modern concepts of Plant Science.
3. To understand the economic importance of plants.

SYSTEMATIC BOTANY
Unit – I
Principles of Taxonomy – Taxonomic structure – Classifications of Plant Kingdom – Biosystematics – Plant Geography – Biogeographical zones of India.

PLANT DIVERSITY
Unit – II
Patterns of variation in morphology and Life History in plants. Broad outlines of classification and evolutionary trends among Algae, Fungi, Bryophytes and Pteridophytes – Principles of Palaeobotany – Economic importance of Algae, Fungi and Lichens.

ANATOMY
Unit – III
Comparative Anatomy and Developmental Morphology of Gymnosperms and Angiosperms – Meristems and Tissue Differentiation and Morphogenesis.

EMBRYOLOGY
Unit – IV
Structural and Functional aspects of pollen and pistil - Androgenesis and Gynogenesis - Pollination Biology – Fertilization – Embryo and Seed development Male sterility – Self and interspecific incompatibility.

PLANT BREEDING
Unit – V
Principles of Plant breeding – Conventional methods of breeding, self, cross pollinated and vegetatively propagated crops - Non-conventional methods of breeding – Polyploidy – Genetic variability – Plant diseases and defensive mechanism.

Books

**BOT O 215/315-PLANT SCIENCE – II**

**Objectives:**
1. To acquire knowledge in recent developments in plant science
2. To impart the functional concepts of plant science.
3. To study about tissue culture techniques

**PLANTS AND HUMAN WELFARE**

**Unit – I**

Plants and civilization, center of origin and Gene diversity of crop plants – utilization, cultivation of plants for food, drug, fibre and industrial values, unexploited plants of potential economic value – plants as a source of renewable energy – Genetic resources and their conservation.

**PLANT PHYSIOLOGY**

**Unit – II**


**PLANT GROWTH AND DEVELOPMENT**

**Unit – III**

Dormancy, Physiology and Biochemistry of seed dormancy and seed germination – Plant Hormones - Hormonal regulation of growth and development – photoregulation, growth responses, physiology of flowering – senescence.

**PLANT TISSUE CULTURE**

**Unit – IV**


**MICROPROPAGATION**

**Unit – V**


**Books:**