# UNIVERSITY OF CALICUT

**SYLLABUS (DRAFT)**

for

**UNDER GRADUATE PROGRAMME**

in

**BOTANY**

Effective from
2014 admission

# Members of Board of Studies –Botany (UG)

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## AIMS AND OBJECTIVES OF THE PROGRAMME

The Board of Studies in Botany (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The restructured Curriculum for Undergraduate Programme of Botany envisages Undergraduate Education as a combination of general and specialized education, simultaneously introducing the concepts of breadth and depth in learning. The present attempt is to prepare the students for lifelong learning by drawing attention to the vast world of knowledge of plants and introducing them to the methodology of systematic academic enquiry. The crew of the syllabus ensures firm footing in fundamental aspects of Botany and wide exposure to modern branches of Botany to the students.

The expected outcome of the syllabus

1. To know the scope and importance of the Botany
2. To inculcate interest in nature with its myriad living forms
3. To develop scientific among students
5. To undertake scientific projects
6. To give better exposure to the diversity of life forms
7. To give awareness about natural resources and their importance in sustainable development
9. To provide opportunities for the application of the acquired knowledge in day to day life.
10. To develop skill in doing practical experiments, familiarizing equipments and biological specimens .

## U.G. PROGRAMME – AN OVER VIEW

**Programme** means the entire course of study and examinations for the award of a degree. **Duration** of an under graduate programme shall be six semesters distributed in a period of 3 years. An **academic week** is a unit of five working days in which distribution of work is organized from Monday to Friday with five contact hours of one hour duration on each day. A sequence of 18 such weeks constitutes a semester. Semester means a term consisting of 90 working days including examination days distributed over a minimum of 18 weeks of 5 working days each.

**Course** means a segment of subject matter to be covered in a semester (traditionally referred to as paper). The under graduate programme include four types of courses, viz., **Common Courses** (Code A), **Core courses** (Code B), **Complementary courses** (Code C) and **Open course** (Code D).

Common course includes compulsory English and additional language courses. Core course comprises compulsory course in a subject related to a particular degree programme. Open course means a course which is opted by a student at his/her choice. Complementary Course refers to a courses related to the core course (traditionally referred to as subsidiary paper).

**Course code**: Each course shall have a unique alphanumeric code number, which includes abbreviation of the subject in three letters, the semester number (1 to 6) in which the course is offered, the code of the course (A -Common course, B-Core course, C-Complementary and D- open course to D) and the serial number of the course (01, 02). For example, BOT2B03 represents a Core course of serial number 03 offered in second semester in B.Sc. Botany Programme. Every under graduate student shall undergo 10 common courses [6 English courses and 4 additional language courses] for completing the programme.

**Core courses**: These are the courses coming under the main (Core) chosen by the student, offered by the parent department varies from 10 to 18 including a project work. **Complementary courses**: Complementary courses cover one or two

disciplines that are related to the core subject and are distributed in the first four semesters. There shall be one **open course** in the fifth semester. Students can opt one open course of their choice offered by any department in the institution other than their parent department.

Each course shall have certain credits. **Credit** is a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course. For passing the degree programme, the students shall required to achieve a minimum of 120 credits of which 38 from common courses; 32 credits from two complementary courses, 2 from open course and 48 from Core courses (including 2 credits for project work).

**Credit Distribution of B.Sc. Botany Programme**

| Semester | Common course | | Core course | Complemen-tary course | | Open | Total |
|---|---|---|---|---|---|---|---|
| | English | Additional Language | | Chem | Zool | | |
| I | 4+3 | 4 | 3 | 3 | 3 | | 20 |
| II | 4+3 | 4 | 3 | 3 | 3 | | 20 |
| III | 4 | 4 | 3 | 3 | 3 | | 17 |
| IV | 4 | 4 | 3+4* | 3+4* | 3+4* | | 29 |
| V | | | 3+4+3 | | | 2 | 12 |
| VI | | | 3+3+3<br>3+2**<br>4*+4* | | | | 22 |
| Total | 22 | 16 | 48 | 16 | 16 | 2 | **120** |

*Credits of Practical Exam

** Credits of Project Work

Every student of a UG Programme has to undertake project work of 2 credits under the supervision of a faculty member as per the curriculum. Project evaluation shall be conducted at the end of the sixth semester.

## EXAMINATION

There shall be university examinations at the end of each semester. A student shall be permitted to appear for the semester examination, only if he/she secures not less than 75% attendance in each semester. Practical examinations shall be conducted by the university at the end of fourth and sixth semester. External viva-voce, project evaluation if any, shall be conducted along with the practical examination.

## EVALUATION AND GRADING

Mark system is followed instead of direct grading for each question. The evaluation scheme for each course shall contain two parts: viz., a. Internal evaluation b. External evaluation.

## INTERNAL EVALUATION

20% of the total marks in each course are for internal examinations. The colleges may send only the marks obtained for internal examination to the university. The internal assessment shall be based on a predetermined transparent system involving attendance, written test, assignments and seminars in respect of theory examinations and on test/ records/viva/ attendance in respect of practical courses.

**Table-1 Components with percentage of marks of Internal Evaluation of Theory and Practical**

| Components | | Theory course | Practical course | Marks distribution | |
|---|---|---|---|---|---|
| | | | | Theory | Practical |
| 1 | Attendance | 25% | 25% | 5 | 5 |
| 2 | Test paper I & II (best of two) | 50% | | 10 | |
| 3<br>4 | Assignment & Seminar | 25% | | 5 | |
| 5 | Record | | 50% | nil | 10 |
| 6 | Lab. involvement | | 25% | nil | 5 |
| 7 | Total | 100% | 100% | 20 | 20 |

**Table-2 Percentage of Attendance and marks eligible**

| % of attendance | % of marks may be awarded | Marks eligible |
|---|---|---|
| Above 90% | 100 | 5 |
| 85-89% | 80 | 4 |
| 80-84% | 60 | 3 |
| 76-79% | 40 | 2 |
| 75% | 20 | 1 |

EXTERNAL EVALUATION

External evaluation carries 80% marks. External evaluation of even semesters (2, 4 and 6) will be conducted in centralized valuation camps immediately after the examination. Answer scripts of odd semester (1, 3 and 5) examination will

be evaluated by home valuation. The external examination in practical courses shall be conducted by two examiners appointed by the university. **After the external evaluation only marks need to be entered in the answer scripts. All other calculations including grading are to be done by the university.**

**Because of the specific nature of the Botany practical examination, the board unanimously decided that both the examiners of the practical examination should be external in order to maintain the secrecy and seriousness of the examination.**

INDIRECT GRADING SYSTEM

Indirect grading system based on a 7-point scale is used to evaluate the performance of students. A student who fails to secure a minimum grade for a pass in a course permitted to write the examination along with the next batch. Each course is evaluated by assigning marks with a letter grade (A+, A, B, C, D, E or F) to that course by the method of indirect grading. An aggregate of E grade with 40 % marks (after external and internal put together) is required in each course for a pass. Appearance for Internal Evaluation (IE) and External Evaluation (EE) are compulsory and no grade shall be awarded to a candidate if he/she is absent for IE/EE or both. E grade or 40 % marks is required for a pass in each course.

**Pattern of Theory question paper**

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set and the question paper setter shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of objective type, short answer type, short essay type /problem solving type and long essay type questions. Different types of questions shall be given different marks to quantify their range.

**For all semesters:**

1. The examination has duration of 3 hours
2. Each question paper has four parts A, B, C & D.
3. Part-A consists of 10 questions and the candidate has to answer all. Each question carries 1 mark. It can be either fill in the blank type or answer in one word type.
4. Part-B consists of 10 short answer type questions and all questions have to be answered in one paragraph or as directed. Each question carries 2 marks.
5. Part-C consists of 8 short essay type questions and the candidate has to answer any 6 out of them. Each question carries five marks.
6. Part - D consists of 3 essay type questions and the candidate has to answer any 2. Each question carries 10 marks.
7. As far as possible the questions will be asked from the whole syllabi of each course. Weightage of each subject in the setting of question papers is in proportion to the instructional hours allotted to respective subjects in the syllabus.
8. Model question papers are given in annexure-1

Table-3 Theory question paper pattern

| Part | No. of questions | Marks | Total Marks |
|---|---|---|---|
| A | 10 | 1 | 1x10 =10 |
| B | 10 | 2 | 2 x10 = 20 |
| C | 6/8 | 5 | 5 x 6 =30 |
| D | 2/3 | 10 | 2 x10 =20 |
| Total | 31 | | 80 |

## PRACTICAL EXAMINATION

Practical examination aims to test the candidate's skill in undertaking specific task and do the same in stipulated time in the best possible way. There must be confidentiality in the problems to be asked in the examination. Moreover, the entire experiments mentioned in the syllabus have to be done and recorded properly. A certified record book is an evidence of the practical works done by the candidate during the course. Therefore, it must be treated seriously and valued properly. Moreover, the genuine work should be appropriately rewarded. Keeping this in mind the board has decided to increase the marks of the record work. The total marks of the record will be 80 [EE=60 and IE=20]. P-I, P-II and P-III carries 20 marks each. The criteria to be observed in the valuation of records are fixed and are appended below.

### External evaluation of Record- Parameters

a. Content should cover the entire topics falls under the individual semesters
b. Neatness and scientific accuracy
c. Number of sheets obtained signature

### Internal evaluation of Practical Paper

| **Components** | **Marks** |
|---|---|
| Attendance | 5 |
| Involvement in Laboratory & Test paper | 5 |
| Quality of record & Timely submission | 10 |
| **Total** | **20** |

### Submissions

### Practical paper - I

Students are expected to submit any five specimens belonging to Algae, Fungi, Lichen and Pathology or together and five articles/specimens/photographs of

Horticultural significance at the time of practical examination to be held at the end of fourth Semester.

**Practical Paper – II & III**

Every student has to submit 15 properly identified herbarium sheets together with field book and tour report duly certified by the Head of the department on the first day of the Practical Examination to be held at the end of the sixth semester for evaluation. Duly certified report of project work done by the student also has to be submitted on the same day for valuation and viva voce.

**Mark distribution of Submissions**

| Submission | Items | Marks |
|---|---|---|
| Pract. P-I | a. Specimens from algae, fungi, lichen and pathology<br>b. Horticulture-Articles/photographs/ specimens | 5<br>5 |
| Pract. P-II | a. Herbarium & Field book<br>b. Tour report | 8<br>2 |
| Pract. P-III | a. Project work<br>b. Viva | 5<br>5 |
| Total | | 30 |

# B.Sc. PROGRAMME IN BOTANY- Core

## Course structure, Work load and Credit distribution

| *Semester* | Paper Code | Title of Paper | Instructional hours/ Semester | Hours allotted / Week | Credit |
|---|---|---|---|---|---|
| ***S- I*** | BOT1B01T | CORE COURSE I. PLANT ANATOMY | **36 hrs** | **2** | **3** |
| | BOT1B01P | CORE COURSE. PRACTICAL -I | **36 hrs** | **2** | |
| ***S -II*** | BOT2B02T | CORE COURSE II. EMBRYOLOGY, PALYNOLOGY & HORTICULTURE | **36 hrs** | **2** | **3** |
| | BOT2B02P | CORE COURSE. PRACTICAL -II | **36 hrs** | **2** | |
| ***S-III*** | BOT3B03T | CORE COURSE III. RESEARCH METHODOLOGY & MICROTECHNIQUE | **54 hrs** | **3** | **3** |
| | BOT3B03P | CORE COURSE. PRACTICAL -III | **36 hrs** | **2** | |
| ***S-IV*** | BOT4B04T | CORE COURSE IV MICROBIOLOGY, PHYCOLOGY, MYCOLOGY, LICHENOLOGY & PATHOLOGY | **54 hrs** | **3** | **3** |
| | BOT4B04P | CORE COURSE. PRACTICAL -IV | **36 hrs** | **2** | |
| | | PRACTICAL PAPER - I - EXTERNAL | | | **4** |
| ***S-V*** | BOT5B05T | CORE COURSE V BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALAEOBOTANY | **90 hrs** | **5** | **3** |
| | BOT5B05P | CORE COURSE. PRACTICAL -V | **36 hrs** | **2** | |
| | BOT5B06T | CORE COURSE VI ANGIOSPERM MORPHOLOGY, SYSTEMATICS, ECONOMIC BOTANY & ETHNO BOTANY | **108 hrs** | **6** | **4** |
| | BOT5B06P | CORE COURSE. PRACTICAL -VI | **36 hrs** | **2** | |
| | BOT5B07T | CORE COURSE VII GENERAL & BIO INFORMATICS, BASIC BIOTECHNOLOGY & MOLECULAR BIOLOGY | **90 hrs** | **5** | **3** |
| | BOT5B07P | CORE COURSE. PRACTICAL VII | **36 hrs** | **2** | |
| | BOT5D01 | OPEN COURSE - CHOICE I GENERAL BOTANY | **54hrs** | **3** | **2** |

| *Semester* | **Paper Code** | **Title of Paper** | **Instructional hours/ Semester** | **Hours allotted / Week** | **Credit** |
|---|---|---|---|---|---|
| | BOT5BD02 | OPEN COURSE - CHOICE II<br>APPLIED BOTANY | **54hrs** | **3** | 2 |
| | BOT5D03 | OPEN COURSE - CHOICE III<br>TISSUE CULTURE | **54 hrs** | **3** | 2 |
| ***S - VI*** | BOT6B08T | CORE COURSE VIII<br>PLANT PHYSIOLOGY & BIOCHEMISTRY | **90hrs** | **5** | **3** |
| | BOT6B08P | CORE COURSE. PRACTICAL VIII | **36 hrs** | **2** | |
| | BOT6B09T | CORE COURSE IX<br>CELL BIOLOGY, GENETICS & PLANT BREEDING | **90 hrs** | **5** | **3** |
| | BOT6B09P | CORE COURSE. PRACTICAL IX | **36 hrs** | **2** | |
| | BOT6B10T | CORE COURSE X<br>ENVIRONMETAL SCIENCE, PHYTOGEOGRAPHY, & EVOLUTION | **90hrs** | **5** | **3** |
| | BOT6B010P | CORE COURSE. PRACTICAL X | **36 hrs** | **2** | |
| | BOT6B011T | ELECTIVE - CHOICE I<br>GENETIC ENGINEERING | **90 hrs** | **5** | **3** |
| | BOT6B011P | ELECTIVE - . PRACTICAL | **36 hrs** | **2** | |
| | BOT6B011T | ELECTIVE- CHOICE II<br>GENETICS AND CROP IMPROVEMENT | **90 hrs** | **2** | 3 |
| | BOT6B011P | ELECTIVE. PRACTICAL | **36 hrs** | **2** | |
| | BOT6B012T | ELECTIVE - CHOICE III<br>RECENT ADVANCES IN PLANT SYSTEMATICS | **90hrs** | **2** | 3 |
| | BOT6B012P | ELECTIVE -. PRACTICAL | **36 hrs** | **2** | |
| | | Project Work | | | **2** |
| | | PRACTICAL PAPER II - EXTERNAL | | | **4** |
| | | PRACTICAL PAPER III - EXTERNAL | | | **4** |

## B.Sc. PROGRAMME IN BOTANY

### Core Course - Botany

### Course Structure, instructional hours, Mark Distribution & Scheme of Examination

| Course Code | Instructional Hours | | Duration of Exams | Marks | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Practical | | |
| | Theory | Practical | | EE | IE | EE | IE | |
| BOT1B01 T | 36 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT2B02 T | 36 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT3B03 T | 54 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| BOT4B03 T | 54 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| Core Pract-I<br>BOT1B01 P, BOT2B02 P,<br>BOT3B03 P & BOT4B04 P | | | 3 hrs | | | 80<br>[50+20+10]<br>*EE+R+Sub | 20 | 100 |
| BOT5B05 T | 90 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT5B06 T | 90 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT5B07T | 90 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| BOT5D01 | 36 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| BOT6B08 T | 90 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT6B09 T | 90 | 36 | 3 hrs | 80 | 20 | -- | -- | 100 |
| BOT6B10 T | 90 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| BOT6B11T | 90 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Core Pract. -II BOT5B05 P, BOT5B06P, & BOT5B07 P | | | 3 hrs | | | 80 [50+20+10] EE+R+Sub | 20 | 100 |
| Core Pract. -II BOT6B08 P, BOT6B09P, & BOT6 B010 P | | | 3 hrs | | | 80 [50+20+10] EE+R+Pro | 20 | 100 |
| Total | | | | 960 | 240 | 240 | 60 | 1500 |

*EE – External Evaluation marks

R- Marks assigned for Record

Sub – Marks assigned for submission

Pro - Project report & viva voce

IE - Internal Evaluation marks

T- Theory

P- Practical

FIRST SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

**CORE COURSE 1- PLANT ANATOMY**

**Code: BOT1B 01T**

[Total 72 hours: Theory 36, Practical 36)]

PLANT ANATOMY

Theory –36 Hrs. [2 hours per week]

Module - I.

1. Plant cell- Structure
   - A. Cell wall – fine structure of primary and secondary wall; cell wall thickening; Pits - simple, bordered, half bordered; Plasmodesmata- their structure and function.
   - B. Growth of cell wall - Apposition, Intussusception
   - C. Extra cell wall materials - lignin, cutin, suberin, callose, wax.
   - D. Cell wall properties. 5 hrs.
2. Non-living inclusions
   - a. Reserve food materials - carbohydrates, proteins, fats & oils
     Carbohydrates - sugars & starch; Starch grains -structure, types with examples;
     Proteins - Aleurone grains with examples; Fats & oils examples.
   - b. Secretory materials
   - c Waste materials - Nitrogenous – alkaloids, Non-nitrogenous- gums, resins, tannins, organic acids, essential oils
     Mineral crystals - Calcium oxallate: Drusses, raphides, styloides
     Calcium carbonate - cystoliths with examples 3hrs.

Module-II

1. Tissues :- Definition -Types

a. Meristematic tissues - classification.

i. Theories on apical organisation - Apical cell theory, Histogen theory, Tunica corpus theory

ii. Organization of shoot apex and differentiation of tissues- (protoderm), procambium and ground meristem should be mentioned).

iii . Kopper-Kappe theory- organization of root apex in dicots- common types with three sets of initials- in monocots – Maize type with four sets of initials 2 hrs.

b Mature tissues- definition classification- simple, complex and secretory

i. Simple tissues – parenchyma, collenchyma, sclerenchyma, - fibres and sclereids- structure, occurrence and function.

ii. Complex tissues - Definition - Xylem & Phloem structure, origin and function

iii. Secretory tissues - glands, glandular hairs, nectaries, hydathodes, schizogenous and lysigenous ducts, resin ducts, Laticifers – articulated and non-articulated

6 hrs.

Module - III

1. Vascular bundles - Origin and types - conjoint, collateral, bi-collateral, open closed, radial, concentric - amphicribral and amphivasal.

2 hrs.

2. Primary structure of:

Dicot root - (Aerial – Ficus/Tinospora)

Dicot stem - Normal (Centella) and bi-collateral (Cephalandra, Cucurbita)

Monocot root – (Colocasia, Musa)

Monocot stem - (Grass/bamboo, Asparagus)

Dicot leaf - (Ixora)

Monocot leaf - (Grass)

Stomata - Dicot, Monocot, Classification (Metcalfe & Chalk) 6hrs.

Module- IV

1. Root - stem transition 1 hr.
2. Nodal anatomy - unilacunar, trilacunar and multi lacunar types - leaf trace and leaf gaps 1 hr.
3. Normal secondary growth in Dicot stem & (Polyalthea, Vernonia); Dicot root (Ficus, Tinospora); Formation of vascular cambial ring - structure and activity of cambium – storied and non-storied, fusiform and ray initials; Formation of secondary wood, secondary phloem, vascular rays, growth ring, heart wood, sapwood. 5 hrs.
4. Extra stelar Secondary thickening in stem and root - Periderm formation. Structure - phellogen, phellem, phelloderm, bark, lenticels - structure & function. 2 hrs.
4. Anomalous secondary growth - general account with special reference to the anomaly in Dicot stem – Boerhaavia, Bignonia and Dracaena 3hrs.

**PRACTICALS**

Practical –36 Hrs. [2 hours per week]

Students are expected to

1. Identify at sight the different types of stomata, tissues and vascular bundles.
2. Study the primary structure of stem, root and leaf of Dicots and Monocots (Examples mentioned in the theory syllabus)

3. Study the secondary structure of Dicot stem and root. (Examples mentioned in theory syllabus)
4. Study the anomalous secondary thickening in Boerhaavia, Bignonia and Dracaena

References


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3. Eames, A. J. & L H Mac Daniels 1987 An Introduction to Plant Anatomy. Tata Mac Grew Hill Publishing company Ltd. New Delhi.
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6. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
7. Sen DN 1974. Anatomy of Angiosperms. S. Nagini & Co.
8. Tayal M.S Plant Anatomy. Rastogi Publishers, Meerut.
9. Vasishta P.C. 1974. Plant Anatomy, Pradeep Publication, Jalandhar.

SECOND SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE- 2: EMBRYOLOGY, PALYNOLOGY & HORTICULTURE

### Code: BOT1B 02 T

[Total 72 hours: Theory 36, Practical 36 ]

EMBRYOLOGY

Theory - 12 Hrs. (1/2 hour per week)

Module-I.

1. Typical Angiosperm flower – morphology of floral organs 1 hr.
2. Anther - structure, dehiscence; microsporogenesis; male gametogenesis 2 hrs.
3. Ovule - structure, types; Megasporogenesis; Female gametogenesis: Monosporic, bisporic and tetrasporic. Structure of typical embryosac, Polygonum, Allium and Adoxa type 3 hrs.
4. Fertilization, syngamy and triple fusion, double fertilization. 1hr.
5. Endosperm formation - Types - Free nuclear, cellular and helobial 1hr.
6. Embryo - Structure of Dicot embryo- Capsella type and Monocot embryo - Sagittaria 2hr.
7. Polyembryony - causes, types and significance 1hr.
8. Parthenocarpy – induction and importance 1hr.

**PRACTICAL**

Total - 9 hours (1/2 hour per week)

Students should identify-

1. Floral transition in Nymphaea
2. Datura anther T.S. (mature)
3. Types of ovules: Orthotropous, Anatropous and Campylotropous
4. Dicot and monocot embryo of Angiosperms (Slides only)

References


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2. Davis C.L. 1965. Systematic Embryology of Angiosperms. John Wiley, New York.
3. Eames M.S 1960. Morphology of Angiosperms Mc Graw Hill New York.
4. Johri BD 1984 (ed.) Embryology of Angiosperms Springer - Verlag, Berlin.
5. Maheswari P. 1985. Introduction to Embryology of Angiosperms - Mac Graw Hill, New York.
6. Sharam & Aswathi: Embryology of Angiosperms.
7. Agarwal S.B. Embryology of Angiosperms- a fundamental approach, Sahithya Bhavan, Hospital Road, Agra.
8. Singh V., P.C. Pande & D.K. Jain 2001;Embryology of Angiosperms- Rastogi Publications, 'Gangothri' Sivaji road, Meerut-


**PALYNOLOGY**

Theory - 6 hrs ($^1/_2$ hour per week)

Module - II

1. Palynology- Introduction, Scope and Significance
2. Pollen morphology – Acetolysis, Pollen wall features - fine structure, pollen kit substance; Pollinium.
3. Pollination - different types, mechanisms and contrivances
4. Pollen viability and pollen storage methods
5. Applied palynology: Aeropalynology; Melitopalynology, Pollen and allergy; Role of pollen morphology in Taxonomy 6 hrs.

PRACTICALS

(Total - 9 hrs.)

1. Study the pollen morphology of Hibiscus, and pollinia of Cryptostegia/ Calotropis by acetolytic method
2. Viability test for pollen

    a. in vitro germination using sugar solution. (cavity slide method)

    b. Tetrazolium test

    c. Acetocarmine test (Acetocarmine & Glycerine 1:1)

References:-


1. Erdtman G 1952. Pollen Morphology and plant Taxonomy Part I. Almiquist & Wicksell Stockholm
2. Erdtman G 1969. Hand Book of Palynology. National Botanical Gardens Publication, Lucknow.
3. Nair PKK 1970. Pollen Morphology of Angiosperms Vikas Publishing House, Delhi.
4. Saxena M.R. Palynology –A treatise-Oxford, I.B.H. New Delhi
5. Shivanna, K.R. & N.S. Rangaswami, 1993. Pollen Biollgy Narosa Publishing House - Delhi.
6. Shivanna & Johri. The Angiosperm Pollen.


## HORTICULTURE

Theory: 18 hours (1 hr per week)

**Module - I**.

1. Introduction, scope and significance; branches of horticulture.
2. Soil- components of soil, types of soil.
3. Fertilizers – Chemical, organic, biofertilizer, compost.
4. Pots & potting – earthen, fibre, polythene bags, potting mixture, potting, repotting, top dressing.
5. Irrigation – Surface, sprinkle, drip and gravity irrigation.

6 hrs.

**Module - II**

1. Seed propagation –seed quality tests, seed treatment, essential condition for successful propagation – raising of seed beds, transplanting techniques.
2. Vegetative propagation:
   (a) Cutting (stem, roots)
   (b) Grafting (approach, cleft)
   (c) Budding (T-budding, patch)
   (d) Layering (simple, air).

6 hrs.

**Module - III**.

1. Gardening – site selection; propagating structure: green house, poly house, moist chamber, net frame – Garden tools and implements.
2. Indoor gardening – selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, creating the bonsai.
3. Outdoor gardening; landscaping- goals, types.
4. Cultivation and post harvest management of vegetables and ornamental plants
5. Protection of Horticultural plants: Precautions to avoid pests and diseases. Bio pesticides
6. Mushroom cultivation – Oyster mushroom

6 hrs.

PRACTICALS

Practical 18 hours

1. Preparation of nursery bed and polybag filling.
2. Preparation of potting mixture – Potting, repotting.
3. Field work in cutting, grafting, budding, layering.
4. Familiarizing gardening tools and implements.
5. Establishment of vegetable garden/ Visit to a Horticulture station.
   (A brief report may be recorded.)
6. Students are expected to submit at least five articles/specimens/

photographs of horticultural significance at the time of Practical Examination Paper-I

**References**


Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.

Andiance and Brison. 1971. Propagation Horticultural Plants.

Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.

Katyal, S.C., Vegetable growing in India, Oxford, New York.

Naik, K.C., South Indian Fruits and their Culture.

Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.

Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.

George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.

Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.

Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India), Jodhpur.

Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.

Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.

Rodgran, M.K. Plant Tissue Culture, Oxford & IBH Publishing Ltd., New Delhi.

Nesamony, S. Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.

Prakash, R and K. Raj Mohan, Jaivakrishi (Organic farming), State Institute of Languages, Trivandrum.

Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.

George Aquah 2005: Horticulture

THIRD SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE- 3: RESEARCH METHODOLOGY AND MICROTECHNIQUE

**Code: BOT3B03T**

[Total 90 hours; Theory 54, Practical 36] [2 hours per week]

## RESEARCH METHODOLOGY

Theory: 36 hrs. (2hours per week)

### Module – I

1. Introduction to science

2. Steps in scientific methods

- observation and thoughts
- formulation of a hypothesis
- designing of experiments
- testing of hypothesis
- formulation of theories 3 hrs.

### Module – II

1. Introduction to Biostatistics: Importance and limitations of Biostatistics
2. Observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations.
3. Data collection: Introduction; Sampling; random and non random.
4. Representation of data; Tables, Bar diagram, Pie diagram, Histogram, Frequency polygon, Ogive, Frequency curve [both manual and using computer].
5. Interpretation and deduction of data, significance of statistical tools in data interpretation, errors and inaccuracies. Documentation of experiments, record keeping. Research report writing; familiarizing biological journals

Latest methods of presentation.

9 hrs.

**Module III**:

1. Measures of central tendency: mean, median and mode
2. Measures of dispersion: Range, Mean Deviation, Variance, Standard Deviation, Coefficient of variation.
3. Correlation and regression (brief account).
4. Probability-Laws of probability: Addition theorem and Multiplication theorem.
5. Probability Distribution: Binomial Distribution, Normal Distribution and Poisson Distribution.
6. Test of hypothesis : Null hypothesis, Alternate hypothesis Chi-square test, and t-test [paired and unpaired]
7. Design of experiments: Latin square, randomized Block design, factorial.

12 hrs.

**Module – IV**:

1. Solutions: representing concentrations: Molarity, Normality, Percentage and ppm.
2. Acids and bases, buffers and pH, measurement of pH. preparation and use of buffers in biological studies.
3. Photometry: Colorimetry and Spectrophotometry, principle, working and uses.
4. Centifugation: Principle, types of centrifuges and their applications
5. Chromatography - Principle and types: Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Molecular sieving.

12 hrs.

**PRACTICALS**

(Total 27 hrs)

1. Preparation of solutions of known concentrations using pure samples and stock solutions
2. Preparation of buffers
3. Measurement of pH using pH meter.
4. Demonstration of the working of different kinds of centrifuges
5. Work out the problems related to mean, median, mode, standard deviation, probability and correlation
6. Familirise the technique of data representation (bar diagram, histogram, pie-diagram and frequency curve (both manual and using computer).
7. Preparation of bibliography
8. Listing scientific journals
9. Preparation of OHP and LCD presentations

**References: Perspectives of Science**


1. P.G. Hewitt, J.A. Suchocki ISBN-10 0805 390385, Conceptual integrated science ISBN-139780805390384.
2. R.G. Newton – The truth of science, Viva Books, New Delhi, II Edition.


**References: Biological techniques**


1. Keith Wilson and John Walker (2008). Principles and techniques of Biochemistry and Molecular Biology 6th edition. Cambridge University Press.
2. Hoppe, W. (edt). 1983. Biophysics. Springer Verlag.
3. Rogers, A.W. 1969. Techniques of Autoradiography. Elsevier Publishing Company.
4. Roy, R.N. 1996. A Text book of Biophysics. New Central Book Agency Pvt. Ltd., Calcutta.
5. Sasidharan, A. 1984. Selected Topics of Biophysics. Frontier Area Publishers.
6. Slayter. E.M. 1970. Optical methods in Biology. Wiley Intersciences.

7. Wong. C.H. 1965. Radiation Tracer Methodology in Biophysical Sciences. Prentice Hall.

**References: Biostatistics**

1. Jasra. P.K. and Raj Gurdeep 2000. Biostatistics.
2. Khan, I.A. and Khayum. Fundamentals of Biostatistics. Wraaz Publ. Hyderabad.
3. Norman, T.J. Bailey. Statistical methods in Biology Cambridge Univ. Press.
4. Prasad, S. 2003. Elements of Biostatistics. Rastogi Publ.
5. Ramakrishnan, P. Biostatistics, Saras Publishers.
6. Rastogi, V.B. Fundamentals of Biostatistics Ane Book India.
7. Norman T.J. Bailey 2007; Statistical Methods in Biology- Low Priced Edition, Cambridge University Press, Replica Press Private Ltd

## MICROTECHNIQUE

Theory: 18 hrs. (1hr. per week)

**Module - 1.**

1. Principles of microscopy – eyepiece lens and objective lenses; Magnification, Resolving power, numerical aperture.
2. Mechanical components: base, pillar, stage, sub stage, body tube, focusing knobs, nose pieces
3. Optical components: mirror, objectives, ocular lens, condenser.
4. Types of microscopes: Light microscope, Compound microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope: Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM)
5. Micrometry – Stage micrometer, Ocular micrometer, Calibration and working.

6. Preparation of illustrations using camera lucida, digital camera and photomicrography 12 hrs.

**Module - II**.

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives – Formaline – Acetic – Alcohol, Carnoy's fluids I & II, Chromic acid – Acetic acid – Formation (CRAF)
2. Dehydration and infiltration – general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series.
3. Infiltration – paraffin wax method, Embedding.
4. Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance.
5. Staining – General account, Classification: natural dyes, coaltar dyes. Double staining, Vital staining
6. Mounting.
7. A brief account on whole mounting, maceration and smears 6 hrs.

**PRACTICALS**

Total: 9 hrs.

1. Parts of microscope and its operation.

2. Free hand sectioning of stem, leaves, Staining and mounting.

3. Measurement - using micrometer.

4. Camera lucida drawing and computation of magnification and actual size.

5. Demonstration of dehydration, infiltration, embedding and microtoming.

References

1. Johansen, D.A. 1940. Plant Microtehnique. Mc Graw – Hill Book Company, Inc. New York.

2. Kanika, S. 2007. Manual of Microbiology – Tools and Techniques. Ane's student edition.

3. Khasim,S.K., 2002. Botanical Microtechnique; principles and Practice, Capital Publishing Company, New Delhi.

4. Toji, T. 2004. Essentials of botanical microtechnique. Apex Infotec Publ.

FOURTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE- 4: MICROBIOLOGY, PHYCOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

**Code: BOT4B04T**

[Total 90 hours: Theory 54 , Practical 36]

### MICROBIOLOGY

Theory- 10 hrs. [1/2 hr. per week]

### Module - I

1. Introduction to Microbiology–.
2. Bacteria – Brief introduction on Bergey's classification; Ultra structure of bacteria; Bacterial growth, Nutrition, Reproduction, Economic importance of bacteria
3. Viruses – Classification, architecture and multiplication, Bacteriophages, TMV, Viriods, Prions.
4. Microbial ecology – Rhizosphere and Phyllosphere.
5. Industrial microbiology –alcohol, acids, milk products single cell proteins
6. Bacterial pure culture techniques – streak plate method, pour plate method.

### PRACTICALS

(Total: 6 Hrs.)

1. Simple staining
2. Gram staining – Curd, root-nodules
3. Culture and isolation of bacteria using nutrient agar medium

References


1. Dubay R.C. & D.K. Maheswari 2000. A Textbook of Microbiology, Chand & Co, New Delhi.
2. Frazier W.C. 1998. Food Microbiology, Prentice Hall of India, Pvt. Ltd.
3. Kumar H.D. & S. Kumar. 1998. Modern Concepts of Microbiology Tata McGraw Hill, Delhi.
4. Pelzar M.J., E.C.S. Chan & N.R. Kreig. 1986. Microbiology McGraw Hill, New York.
5. Rangaswami, R & C.K.J. Paniker. 1998. Textbook of Microbiology, Orient Longman.
6. Ross, F.C. 1983. Introductory Microbiology. Charles E. Merill Publishing Company.
7. Sharma P.D., 2004. Microbiology and Plant Pathology Rastogi Publication.
8. Hans g Schlegel21012; General Microbiology- Cambridge University Press Low Priced Indian Edition, , Replica Press Pvt. Ltd.


**MYCOLOGY**

(Total; 12 hrs.) [1/2 hr. per week]

**Module - I**

1. Introduction – General characters and phylogeny
2. A general outline on classification – Ainsworth and Bisby (1983)
3. Mastigomycotina : General characteristics, occurrence, reproduction, and life cycle – Type: Pythium, Albugo
4. Zygomycotina: General characteristics, occurrence, reproduction, and life cycle – Type: Mucor
5. Ascomycotina: General characteristics, occurrence, reproduction and life cycle – Type: Peziza.

6. Basidiomycotina: General characteristics, occurrence, reproduction and lifecycle -Types: Puccinia, Agaricus
7. Deuteromycotina: General characteristics, occurrence reproduction and life cycle- Type: Cercospora.
8. Economic importance of fungi: Medicinal, industrial, Agricultural, Food, Genetic Studies and fungal toxins.

**PRACTICALS**

(Total: 10 hrs.)

1. Micropreparation – Lactophenol cotton blue – Slides of the above mentioned types.

References


1. Alexopoulos C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology, 4th Edn. JohnWiley and Sons, New York.
2. Alexopoulos, C.J. and Mims C.W. 1979. Introductory Mycology, 3rd Edition, John Wiley and Sons, New York.
3. Mehrotra R.S. and Aneja K.R. 1990. An Introduction to Mycology, Wiley, Eastern Limited, New Delhi..


**LICHENOLOGY**

(Theory: 6 hours)

1. Introduction: Type of Interaction between the components symbiosis – mutualism.
2. Growth forms – Crustose (Paint like), filamentous (hair-like), foliose (leafy), and fruticose (branched)
3. Taxonomy and Classification based on fungal partner
4. Reproduction and Dispersal – Fragmentation, isidia, soridia, cephaloidea, cephala
5. Sexual Reproduction – Typical of fungal partner, producing spores.

6. Economic Uses: Dyes, Cosmetics and perfumes, Medicinal uses- (in nanomedicine (Usnea longissima), treatment of cancer, Homoeopathy). Toxicology, Lichens as food, Bioremediation, Ecological indicators, Pollution indicators, Lichen in Soil formation and pioneers of Xerosere.

**PRACTICALS**

(Total: 4 hrs.)

1. Identification of different forms of Lichens mentioned in the syllabus.

References


1. Gilbert, O. 2004. Lichen Hunters. The Book Guild Ltd. England
2. Kershaw, K.A. 1985. Physiological Ecology of Lichen Cambridge University Press.
3. Mamatha Rao, 2009 – Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
4. Sanders, W.B. 2001. Lichen interface between mycology and plant morphology. Bioscience, 51: 1025-1035.
   http://www.lichen.com
   http://www.newscientistspace.com


**PHYCOLOGY**

Theory-18 Hrs. [1hr.per week]

1. Introduction
2. Classification of Algae. Fritsch (1935).
3. General Features: Occurrence, cell morphology, range of thallus structure, reproduction and life cycles.

4. Chlorophyceae : General characteristics, occurrence, thallus structure, cell structure, flagella, reproduction, interrelationships. Types -Chlamydomonas, Volvox, Spirogyra, Oedogonium, Chara.
5. Xanthophyceae : General characteristics, occurrence, range of thallus structure, reproduction, interrelationships. Type- Vaucheria.
6. Bacillariophyceae (Diatoms) General characteristics, occurrence, thallus structure, cell structure, cell division, sexual reproduction, auxospores, classification, interrelationships. Type -Pinnularia.
7. Phaeophyceae : General characteristics, occurrence, range of thallus structure, anatomy, cell structure, flagella, reproduction, alternation of generations, interrelationships. Type - Sargassum.
8. Rhodophyceae : General characteristics, occurrence, range of thallus structure, cell structure, reproduction, life cycle, phylogeny and interrelationships.Type-Polysiphonia.

9. Economic Importance: Algae as food, fodder, green manure, bio-fuels, pollution indicators, research tools, medicinal uses of algae, Commercial Products – carrageenin, agar-agar, alginates, diatomaceous earth. Harmful effects – Water bloom, eutrophication, neurotoxins, parasitic algae.

**PRACTICALS**

(Total: 10 hrs.)

1. Identify the vegetative and reproductive structures of the types studied.
2. Familiarizing the technique of preparation of algal herbarium.

References

1. Anand, N. 1989. Culturing and cultivation of BGA. Handbook of Blue Green Algae Bishen Sing Mahendra Pal Sing.
2. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.

3. Kanika Sharma 2007. Manual of Microbiology. Tools and Techniques 2nd Edition. Ane Books India. (pp. 376-377. Composition of media used for algal culture.
4. Mamatha Rao. 2009. Microbes and Non flowering plants: impact and application. Ane Books Pvt. Ltd., New Delhi.
5. Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
6. Papenfuss, G.F. 1955. Classification of Algae.
7. Rober Edward Lee 2008; Phycology:Cambridge University Press india Pvt. Ltd. Ansari Road, New Delhi
8. Van Den Hoek, D.G. Mann and H.M. JaHns 2009: Cambridge University Press India Pvt. Ltd. Ansari Road, New Delhi.

**PLANT PATHOLOGY**

Theory: 8 hrs. [1/2 per week]

1. Introduction – Concepts of plant disease, pathogen, causative agents, symptoms
2. Mechanism of disease resistance (morphological, physiological anatomical, biochemical and genetic), Physiology of parasitism (fungal toxin).
3. Symptoms of diseases: spots, blights, wilts, rots, galls, canker, gummosis, necrosis, chlorosis, smut, rust, damping off.
4. Control measures: Chemical, biological and genetic methods, quarantine measures.
5. Brief study of Plant diseases in South India (Name of disease, pathogen, symptom and control measures need to be studied. )
   1. Citrus Canker 2. Mahali disease of Arecanut, 3. Blast of Paddy, 4. Quick Wilt of pepper, 5. Mosaic disease of Tapioca, 6. Bunchy top of Banana. 7. Root wilt of coconut.

**PRACTICALS** (6 hrs.)

Identification of the disease, pathogen, symptoms and control measures of the following:

1. Citrus canker
2. Mahali disease
3. Tapioca mosaic disease
4. Blast of Paddy
5. Quick wilt of pepper

**Submission**

Students are expected to submit any five preserved specimens (either wet or dry)belonging to Algae, Fungi, Lichen or Pathology mentioned in the syllabus during the Practical Examination Paper-I held at the end of Fourth semester.

References


Agros, G.N. 1997. Plant Pathology (4th ed) Academic Press.

Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.

Mehrotra, R.S. 1980. Plant Pathology – TMH, New Delhi.

Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.

Rangaswami, G. 1999. Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.

Sharma P.D. 2004. Plant Pathology Rastogi Publishers.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE - 5: BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS AND PALAEOBOTANY

Code: BOT5B05T

[Total 126 hours: Theory 90, Practical 36]

## BRYOLOGY

Theory-18 hrs [1hr per wek]

### Module - I

1. Introduction, general characters and classification by Proskauer,1957 $1^1/_2$ hrs.
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required)
    a. Riccia (Hepaticopsida)
    b. Anthoceros (Anthocerotopsida)
    c. Funaria (Bryopsida) 12 hrs.
3. Evolution of gametophyte and sporophyte among Bryophytes 2 hrs.
4. Economic importance of Bryophytes 1 hr.
5. Contribution of Indian Bryologists 1 hr.
6. Fossil Bryophytes ½ hr.

### PRACTICALS

Total: 9 hrs.

1. Riccia – Habit, Anatomy of thallus, V.S. of thallus through antheridium, archegonium and sporophyte.
2. Anthoceros- Habit, Anatomy of thallus. V.S. of thallus through antheridium,

archegonium and sporophyte.

3. Funaria- Habit, structure of antheridial cluster, archegonial cluster, L.S. of sporophyte.

References


1. Campbell H.D, 1940, The Evolution of land plants (Embryophyta), Univ. Press, Stanford.
2. Chopra R.N. and P.K. Kumar, 1988, Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
3. Gangulee Das and Dutta., College Botany Vol.1, Central Book Dept. Calcutta.
4. Parihar, N.S. An Introduction to Bryophyta Central Book Depot, Allhabad, 1965.
5. Shaw.J.A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.
6. Smith G.M. 1938, Crytogramic Botany Vol.II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.
7. Sporne K.R.,1967, The Morphology of Bryophytes. Hutchinson University Library, London.
8. Vasishta B.R. Bryophyta. S. Chand and Co. New Delhi.
9. Watson E.V. 1971, The structure and life of Bryophytes. Hutchinson University Library, London.
10. Gangulee, H.C. and Kar A.K. College Botany Vol.II, New Central Book Agency, Calcutta.


**PTERIDOLOGY**

Theory-36 hrs [2 hrs. per week]

## Module- I

1. Introduction, general characters and classification (Smith et al., 2008 – brief outline only) 4 hrs.

2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required)

   a. Psilotum (Psilopsida) 4 hrs.
   b. Selaginella (Lycopsida) 4 hrs.
   c. Equisetum (Sphenopsida) 4 hrs.
   d. Pteris & Marsilea (Pteropsida) 8 hrs.

3. Apogamy and apospory in Pteridophytes; Stelar evolution in Pteridophytes; Heterospory and seed habit; Affinities of Pteridophytes; Economic importance of Pteridophytes with special reference to biofertilizers: Contribution of Indian Pteridologists 12 hrs.

**PRACTICALS**

Total: 16 hrs. [1 hr. perweek]

Psilotum- habit, T.S. of stem, C.S. of synangium (slides only)

Selaginella – habit, T.S. of stem, T.S. of rhizophore, L.S. of strobilus

Equisetum - habit, T.S. of stem, L.S. of strobilus

Pteris - habit, T.S. of stem, C.S. of sporophyll

Marsilea - habit, T.S. of stem, L.S. of sporocarp

**References**


1. Bower, F.O. 1935, Primitive Land Plants – Cambridge, London.
2. Chandra S. & Srivastava M., 2003, Pteridology in New Millenium, Khuwer Academic Publishers.
3. Eames, A.J. 1979, Morphology of Vascular Plants, lower group. Wiley International edition, New Delhi.

4. Parihar, N.S. 1977, Biology and Morphology of Pteridophytes, Central Book Depot, Allhabad.
5. Pichi Sermolli, R.E.G. 1977, A tendative classification of Pteridophyte genera. Webbia 31 (2): 313-512.
6. Rashid, A. 1976, An Introduction to Pteridopyta, Vikas publ. Co. New Delhi.
7. Smith G.M. 1938, Cryptogamic Botany Vol. .II. Bryophytes and Pteridophytes. McGraw Hill Book Company, London.
8. Sporne, K.R. 1967, Morphology of Pteridophytes – Hutchi University Library, London.
9. Sreevastava, H.N. A text book of Pteridophyta.
10. Vasishta B.R. 1993, Pteridophyta – S. Chand and Co., New Delhi

**GYMNOSPERMS**

Theory- 26 hrs. [$1\frac{1}{2}$ hrs per week]

1. Introduction, General characters and classification of Gymnosperms (Sporne, 1965) 4 hrs.

2. Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): a. Cycas, b. Pinus, c. Gnetum 15 hrs.

3. Evolutionary trends in Gymnosperms; Affinities of Gymnosperms with Pteridophytes and Angiosperms 5 hrs.

4. Economic importance of Gymnosperms. 2 hrs.

**PRACTICALS** Total: 9 hrs.

1. Cycas- Habit, coralloid root, T.S. of coralloid root, T.S. of leaflet, T.S. of rachis, male cone and L.S. of male cone , microsporophyll, megasporophyll, T.S. of microsporophyll, L.S. of ovule and seed.

3 hrs.

2. Pinus- branch of unlimited growth, spur shoot, T.S. of stem and needle, male cone and female cone, L.S. of male cone and female cone, seed. 3 hrs.

3. Gnetum- Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed. 3 hrs.

References


1. Chamberlain C.J., 1935,Gymnosperms – Structure and Evolution, Chicago University Press.
2. Coutler J.M. and C.J. Chamberlain, 1958, Morphology of Gymnosperms. Central Book Depot. Allahabd.
3. Sporne K.R. 1967, The Morphology of Gymnosperms, Hutchinson and Co. Ltd. London.
4. Sreevastava H.N. 1980, A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
5. Vasishta P.C. 1980, Gymnosperms. S. Chand and Co., Ltd., New Delhi.


**PALAEOBOTANY**

Theory-10 hrs, [1/2 hr. per week]

1. Introduction and objectives 1 hr.

2. Fossil formation and types of fossils 1 hr.

3. Geological time scale- sequence of plants in geological time 1 hr.

4. Fossil Pteridophytes-Rhynia, lepidocarpon and Calamites 3 hrs.

5. Fossil gymnosperms- Williamsonia 1 hr.

6. Importance of Indian paleobotanical Institutes (brief) 1hr.

7. Brief mention of fossil deposits in India ½ hr.

8. Indian Palaeobotanists: Birbal Sahni and Savithri Sahni ½ hr.

9. Applied aspects of Palaeobotany- exploration of fossil fuels 1 hr.

**PRACTICALS**

Total: 2 hrs.

Fossil Pteridophytes - Rhynia stem, Lepidodendron, and Calamites

Fossil gymnosperms- Williamsonia

**References:**


Andrews H.N. 1961, Studies in Paleobotany. John Wiley and Sons Inc., New York..

Arnold C.A., 1947, Introduction to paleobotany, Tata McGraw Hill, New Delhi.

Shukla, A.C. & S.P. Misra, 1975, Essential of Palaeobotany, Vikas Publishing House, Pvt. Ltd., Delhi.

Sreevastava H.N., 1998, Palaeootany, Pradeep Publishing Company, Jalandhan.

Sewart, W.N., 1983, Palaeobotany and the Evolution of Plants. Cambridge Uni. Press, London.

Taylor, T.N. Paleobotany. An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.

Steward A.C.,1935, Fosil Plants Vol. I to IV.

Watson J. An introduction to study of fossil plants. Adams and Charles Black Ltd. London.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE-6: ANGIOSPERM MORPHOLOGY, SYSTEMATICS, ECONOMIC BOTANY AND ETHNOBOTANY

Code: BOT5B06T

[Total 144 hours: Theory 108, Practical 36]

### ANGIOSPEM MORPHOLOGY

Theory 36 - Hrs. [2 hrs. per week]

I Morphological description of a flowering plant; Plant habit 2 hrs.

A. Root: Types - Tap root, fibrous root; Modifications - Definition with examples - Storage, aerial, pneumatophores, buttress 3 hrs.

B. Stem: Habit - Acaulescent, Caulescent, Cespitose Prostrate, Repent, Decumbent, Arborescent, Suffrutescent (Definition with examples only); Modification - Underground, Aerial, Subaerial with examples 6 hrs.

C. Leaves: Lamina, petiole, leaf tip, leaf base, stipule, pulvinus; Phyllotaxy; types - simple and compound; shapes of lamina; leaf tip; leaf base; leaf margin; leaf surface features: hairiness - tomentose, glabrous, scabrous, strigose, hispid. 5 hrs.

II Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium verticillaster, thyrsus) 7 hrs.

II Flower: Flower as a modified shoot - detailed structure of flowers - floral parts -their arrangement, relative position, cohesion and adhesion - symmetry of flowers - floral diagram and floral formulae. 7 hrs.

III. Fruits – simple, aggregate and multiple with examples; Seed structure - dicot and monocot - albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations.

6 hrs.

PRACTICALS

(Total: 8 hours)

1. Students are expected to identify the types mentioned in the syllabus.
2. The typical examples of types mentioned under inflorescence and fruits must be recorded.

References

1. Gangulee, H.C., J.S. Das & C. Dutta. 1982. College Botany (5th Ed.) New Central Book Agency, Calcutta.
2. George, H.M. Lawrence. 1951. Introduction to Plant Taxonomy. Mac Millan comp. Ltd., New York.
3. Simpson, M. G. 2006. Plant Systematics. Elsevier Academic Press, London
4. Ananta Rao T. Morphology of Angiosperms.

**SYSTEMATICS**

**Theory: 54 hrs.** [3 hrs. per week]

**Module-I**

1. Components of systematics: identification, description nomenclature and classification; objectives and importance of systematics 2 hrs.
2. Development of Plant systematics: Folk taxonomy, Herbalists, Early taxonomists: Caesalpino, Bauhin; Linnaeus; Natural systems - Adanson, de

candolle, Bentham & Hooker; Phylogenic systems: Eichler, Engler, Bessy, Hutchinson, Sporne, Cronquist; Phenetics; Cladistics (Brief account of various phases) 3 hrs.

3. Systems of classification: Artificial – Linnaeus; Natural – Benthem and Hooker; Phylogenetic – Engler and Prantl. Angiosperm Phylogeny Group system – introduction only. (Detailed study of Benthem and Hooker's system only). 5 hrs.

**Module - II**

1. Detailed study (systematic position, distribution, common members, diagnostic features, description from habit to fruit, economic importance) of the following families.

   Annonaceae, Malvaceae, Rutaceae, Fabaceae with sub families, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Poaceae. 17 hrs.

**Module- III**

1. Taxonomic structure – Hierarchy; Concepts of taxa: Species – Biological, Phenetic and Phylogenetic; Genus; Family. 3 hrs.
2. Taxonomic character – concept, primitive and advanced characters, sources, comparative morphology, vegetative, reproductive, Macro and micromorphology, modern trends in taxonomy, cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy and phylogenetics. 5 hrs.
3. Contributions of eminent Taxonomists viz Hendrich van Rheed, William Roxburg, Robert White and G. S. Gamble. 2 hrs.

**Module - IV**

1.Plant nomenclature – Limitations of common name, ICBN, Principles (introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Priority – merits and demerits; Effective and valid publication; Author citation.

8 hrs.

2. Plant identification – Keys; indented and bracketed, construction and applications. 3 hrs.

3. Taxonomic information resources – Herbarium preparation and maintenance, Herbarium types: International- Kew (K); National-Central national herbarium (CAL), MH Coimbatore. Botanic Gardens: RBG, Kew, IGB, Kolkotta; JNTBGRI and Malabar Botanical Garden, Olavanna , Kozhikode.

4 hrs.

4. Taxonomic literature- Floras, Monographs, Revisions, Journals and online resources & Databases. 2 hrs.

**PRACTICALS**

Total: 30hrs.

Students are expected to work out at least two members of each family mentioned in the syllabus and make suitable diagrams, describe them in technical terms and identify up to species using the flora.

1. Students shall be able to prepare artificial key to segregate any five given plants and must be recorded.
2. Students shall submit not less than 15 properly identified herbarium specimens of varying taxa during time of their practical examination.
3. It is compulsory that every student has to undertake a field study tour of not less than 3 days for observing plant diversity under the guidance of teachers of

the Department in the 5th semester. Moreover, they have to submit a tour report countersigned by the Head of the department during the practical examination.

If a student fails to undergo the study tour he /she may not be permitted to attend the examination.

**References**


Forman, L. & D. Bridson. 1989. The herbarium Hand Book. Royal Botanic Gardens, Kew

Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.

Sporne, K.R. 1974. Morphology of Angiosperms. Hutchinson University Press London.

Radford, A.E. 1986. Fundamentals of plant systematics. Harper & Row Publishers, New York.

NaiK, V.N. Taxonomy of Angiosperms. TATA McGraw Hill, New Delhi

Burkill, I.H. 1965. Chapters on the History of Botany in India, Delhi.

Gurucharan Singh, 2001. Plant systematics - Theory and Practice. Oxford & IBH, New Delhi.

Davis, P.H. & V.H. Heywood, 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd Ltd., London.

Henry, A.N. & Chandrabose An aid to International Code of Botanic Nomenclature.

Jeffrey, C. 1968. An introduction to Plant Taxonomy, London.

Simpson, M.G. 2006. Plant Systematics. Elsevier Academic Press, London

Stressy, T.F. 1990. Plant Taxonomy – The systematic evaluation of Comparative data. Columbia University Press, New York.

Sharma, B.D. et al. (Eds.) Flora of India vol. I. Botanical Survey of India, Calcutta.

Sambamurthy A..S.S. 2005;Taxonomy of Angiosperms, i.K. International Pvt. Ltd, New Delh.

Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.

Sharma, O.P. 1996. Plant Taxonomy. TATA McGraw Hill, New Delhi.

Clive A. Stace 1991: Plant Taxonomy and Biosystematics, Cambridge University Press.

Bharati Bhattacharyya 2009; Systematic Botany, Narosa Publishing House Pvt. Ltd., New Delhi.

Mondal A.K. 2009: Advanced Plant Taxonomy, New Central Book agency Pvt. Ltd. KolKota.

**ECONOMIC BOTANY** 12 hrs.

Study the different category of economically important plants their Binomial, Family and Morphology of useful part, products and uses:

1. Cereals and Millets – Rice, Wheat, Maize and Ragi
2. Pulses and legumes – Green gram, Bengal gram, Black gram,
3. Sugar – Sugar cane
4. Fruits – Apple, Pine Apple, Papaya, Banana, Mango, Guava, Jack, Grapes, Sapota.
5. Vegetables – Carrot, Beet Root, Colocasia, Elephant foot yam, Dioscorea Potato, Bitter gourd, Cucumber, Snake gourd, Ladies finger, Cabbage, Amaranthus,
6. Ornamentals – Rose, Anthurium, Jasmine.
7. Masticatories – Betel vine, Betel nut, Tobacco.
8. Beverages – Coffee, Tea, Cocoa.
9. Fibre – Coir, Cotton, Jute.

10. Timber – Teak, Rose wood, Jack, Ailanthus.
11. Fats and oils – Coconut, Gingelly, Sun flower.
12. Latex – Rubber
13. Gums and Resins – Dammar, Gum Arabic, Asafoetida
14. Spices – Pepper, Ginger, Cardamom, Clove, Nutmeg, Allspice, Cinnamon
15. Medicinal – Adhatoda, Catheranthus, Phyllanthus, Rauvolfia, Aloe

**PRACTICALS**

(Total: 4hrs)

1. Students shall learn to identify plants or plant products (raw or processed) studied in theory and shall be able to write Botanical names, Family and morphology of useful parts of source plants.
2. Students need not draw diagrams in the record but prepare a table with important details of each items mentioned in the theory syllabus.

**Module – V.** ETHNOBOTANY

Theory: 6 hrs.

1. Introduction, scope and significance
2. Major tribes of South India
3. Ethanobotanic significance of the following:
    1. Aegle marmalos
    2. Ficus religiosa
    3. Curcuma longa
    4. Cynadon dactylon
    5. Ocimum sanctum
    6. Trichopus zeylanica

PRACTICAL

Total: 2hrs

1. Students are expected to identify the plants mentioned in the Ethnobotany syllabus and it must be given as a table showing Common name, Binomial, Family and Ethnobotanical significance in the record book.

References

Jain. S. K. 1981. Glimpses of Indian Economic Botany. Oxford

Baker. H.g. 1970. Plant and Civilization.

Jain. S. K. 1995. A Manual of Ethnobotany. Scientific Publishers , Jodhpur.

Cotton, C.M. 1996. Ethnobotany – Principles AND Applications. Wiley and Sons.

Bendre Kumar 2000: Economic Botany' Rastogi Publcations, Shivaji road, meerut.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE-7: GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY AND MOLECULAR BIOLOGY

Code: BOT5B07T

[Total 126 hours: Theory 90, Practical 36]

### GENERAL INFORMATICS

Theory: 9 hrs. [$^1/_2$ hr. per week]

**Module-I**

1. Definition, salient features and scope of information technology.

2. Internet as a knowledge repository, data and metadata. Internet protocols – IP address and Domain Name System, URL.

3. Searching the internet: Browsers, search engines, Meta search engines, Boolean searching.

4. IT in teaching, learning and research: Web page designing and web hosting. Academic web sites, e-journals, Open access initiatives and open access publishing, education software, academic services - INFLIBNET, NICNET, BRNET. 3 hrs.

**Module – II**

1. IT and society- issues and concerns. The digital divide, the free software debate; The concept of Wiki. Wikipedia, Wiki dictionary, Wikimedia.
2. Social network sites, Orkut, Facebook, Linkedin, Google Plus, Twitter etc. Emerging trends, benefits, potential for misuse and hazards.
3. Cyber ethics, security, cyber crimes, cyber addiction, information overload.
4. Health issues: guidelines for proper usage of computers and internet.
5. e-wastes and green computing. 3hrs.

**Module – III**

1. IT Application: e-governance at national and state levels, overview of IT application in medicine, healthcare, publishing, communication, resource management, weather forecasting, education, film and media. IT in service of the disabled.
2. Futuristic IT - Artificial intelligence, virtual reality, bio-computing. 3hrs.

**PRACTICAL**

Total: 6 hrs.

1. Familiarizing various search engines and sites.

## BIOINFORMATICS

Theory : 18 hours [1hr. per week]

**Module-1**

1. Introduction to Bioinformatics, scope and relevance.
2. Biological data bases, Genomics and Proteomics; Nucleotide sequence database – EMBL, Gen Bank, DDBJ; Protein sequence database – PDB, Uri Prot, PIR , Organismal database – Human genome database Biodiversity database – Species 2000
3. Information retrieval from Biological database, sequence alignment types and tools: pair wise sequence alignment multiple sequence alignment, clustal 8 hrs.

**Module-2**

1. Genomics: DNA sequencing Sangers procedure-automation of DNA sequencing, genome sequence assembly.
2. Genome projects – Major findings and relevance of the following genome projects – Human, Arabidopsis thaliana, Rice, Haemophilus influenza.
3. Proteomics : Protein sequencing- automation of sequencing, protein structure prediction and modelling (Brief account only)

7 hrs.

**Module-3**

A brief account on

1. Molecular phylogeny and phylogenetic trees.
2. Molecular visualization – use of Rasmol.
3. Molecular docking and computer aided drug design. 3 hrs.

## PRACTICALS

Total: 10 hrs.

1. Familiarizing with the different data bases mentioned in the syllabus.
2. Molecular visualization using Rasmol.
3. Blast search of nucleotide sequences.

## Reference


1. Jin Xiong 2006: Essential bioinformatics, Cambridge University Press, Replika Press Pvt. Ltd.
2. Dov Stekel (2005) Microrray Bioinformatics; Cambridge university press.
3. Attwood DJ and Arry Smith Introduction to Bioinformatics; Pearson education
4. David W. Mount (2004) Bioinformatics – sequence and Genome analysis; CBS Publishers and Distributers.
5. Ignacimuthu S(2005) Basic Bioinformatics; Narosa Publishing House.
6. Lesk AM(2005) Introduction to Bioinformatics: Oxford University Press.


## MOLECULAR BIOLOGY

Theory -26 Hrs. [$1\frac{1}{2}$ hrs per week]

### Module – I.

1. Nucleic acids

a. DNA – the genetic material; the discovery of DNA as the genetic material; bacterial transformation (Griffith's & Avery's experiments); Hershey and Chase experiment; Structure of DNA, Watson & Crick's Model, Types of DNA-(A,B,Z); Replication –semi conservative replication – Meselson and Stahl's experiment; Molecular mechanism of Replication 8 hrs.

b. RNA- structure, types and properties. 2 hrs.

2. Gene action - One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis; concept of colinearity; modern concept of gene-cistrons, recons and mutons 4 hrs.

3. Genetic code - Characters of genetic code 2 hr.

4. Central dogma protein synthesis; Transcription, post-transcriptional modification of RNA, translation; Teminism. 4 hrs.

5.Gene regulation in prokaryotes - operon concept, Lac operon, trp. operon)

1 hr.

6. Gene regulation in eukaryotes (brief account) 2 hrs.

7. Mutation-spontaneous and induced; causes and consequences. Types of mutagens and their effects. Point mutations- molecular mechanism of mutation- Transition, Transversion and substitution

2 hrs.

Reference


1. Brown T A. Genomes. John Willey and Sons
2. Lewin Benjamin. Genes. Oxford University Press
3. Hawkins, J D. Gene Structure and Expression. Cambridge University Press


**INTRODUCTORY BIOTECHNOLOGY**

Theory: 36 hours [2 hrs per week]

**Module-1**

1. The concept of biotechnology, landmarks in the history of biotechnology.

2. Plant tissue culture – Principles and techniques; Cellular totipotency; in vitro differentiation – de differentiation and re-differentiation.
3. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium; Murashige and Skoog medium – composition and preparation.
4. Aseptic techniques in *in vitro* culture – sterilization – different methods – sterilization of instruments and glassware, medium, explants; working principle of laminar air flow and autoclave.
5. Preparation of explants – surface sterilization, inoculation, incubation, subculturing.
6. Micropropagation - Different methods – apical, axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis.
7. Different phases of micropropagation – multiple shoot induction, shoot elongation, *in vitro* and *in vivo* rooting hardening, transplantation and field evaluation; Advantages and disadvantages of micropropogation. Somaclonal variation. 10 hrs.

**Module – II**

1. Methods and Applications of tissue culture:
   a. Shoot tip and meristem culture
   b. Somatic embryogenesis and synthetic seed production
   c. Embryo culture
   d. Protoplast isolation culture and regeneration – transformation and transgenics
   e. Somatic cell hybridization, cybridization.
   f. In vitro secondary metabolite production — cell immobilization, bioreactors
   g. In vitro production of haploids – anther and pollen culture
   h. In vitro preservation of germplasm 10 hrs.

**Module -III**

1. Recombinant DNA Technology: Gene cloning strategies – recombinant DNA construction – cloning vectors – plasmids pBR322, bacteriophage based vectors, Ti plasmids. Restriction endonucleases and ligases transformation and selection of transformants – using antibiotic resistances markers, southern blotting; PCR.
2. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, electroporation, microinjection, biolistics. Agrobacterium mediated gene transfer gene library, gene banks. 10 hrs.

**Module -IV**

1. Application of Biotechnology in :

a. Medicine - Production of human insulin, human growth hormone and

b. Forensics - DNA finger printing.

c. Agriculture - Genetically modified crops – Bt crops, Golden rice, Flavr Savr Tomato, Virus, herbicide resistant crops, Edible vaccines.

d. Environment- Bioremediation- use of genetically engineered bacteria- superbug.

e. Industry- Horticulture and Floriculture Industry, production of vitamins, amino acids and alcohol. 3 hrs.

**PRACTICALS**

Total: 20 hrs

1. Preparation of nutrient medium – Murashige and Skoog medium using stock solutions,
2. Familiarize the technique of preparation of explants, surface sterilization, inoculation and subculturing
3. Extraction of DNA from plant tissue.
4. Preparation of synthetic seeds
5. Demonstration of anther culture

6. Study of genetic engineering tools and techniques using photographs/diagram (Southern blotting, DNA finger printing, PCR,)
7. Visit a well equipped biotechnology lab and record the report.

**References**


1. Brown TA (2006) Gene cloning and DNA anlaysis; Blackwell scientific publishers
2. Chawla HS (2000) Introduction to Plant Biotechnology
3. Das, H.K. (Ed) 2005. Text book of Biotechnology (2nd ed) Wiley India (Pvt.), Ltd. New Delhi.
4. Dubey RC Introduction to Plant Biotechnology; S Chand & Co
5. Gamborg, O.L. & G.C. Philips (Eds.) 1995. Plant Cell, Tissue and Organ Culture: Fundamental Methods. Narosa Pulishing House, New Delhi.
6. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.
7. Hammond, J., Megary, P *et al.* 2000. Plant Biotechnology. Springerverlag.
8. Ignacimuthu S (1997) Plant Biotechnology, New Hampshire Science Publishers
9. Lewin B (2004) Genes VIII. Oxford University Press
10. Purohit SS (2003) Agricultural Biotechnology, Agrobios (India)
11. Razdan MK (1995) Introduction to Plant Tissue Culture. Oxford & IBH publishing Co. Pvt. Ltd.
12. Reinert & Bajaj Plant Cell, Tissue and Organ Culture.
13. Sobti RC & Pachauri SS (2009) Essentials of Biotechnology; Ane Books, New Delhi


# OPEN COURSES

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

**OPEN COURSE - Choice -1: GENERAL BOTANY**
**Code: BOT5D01**

Total – 54 hrs

**Module -1: Living World**

Living and Non Living: Plants and Animals; Classification of plants- Eichler's system – general characters of each group with one example. An introduction to the Life cycle of plants.

6 hrs.

**Module - 2: Morphology of Angiosperms**

Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential parts, symmetry. Pollination, seed dispersal of fruits and seeds.

6 hrs.

**Module - 3: Anatomy**

Definition, general structure, Cell division- mitosis and meiosis, significance, cell cycle. Tissues: simple , compound; structure and functions; Structure and functions of root, stem and leaves. Monocot and Dicot stem- general features; Secondary thickening. Annual rings, heart wood and sap wood.

6hrs

**Module- 4: Plant physiology**

General account on methods of absorption of water and nutrients; Osmosis, Diffusion, Imbibition. Transport of water and nutrients; transpiration and its significance. Mineral nutrients: macro and micro; deficiency symptoms Symbiotic nitrogen fixation and its significance. Photosynthesis- Light and Dark reactions-brief description, Respiration and Growth Hormones. 12 hrs.

**Module - 5: Genetics**

Heredity, variation; Mendelian experiments and principles. Exceptions of Mendelism – Structure and significance of DNA; Mutation. DNA: as the Genetic Material; Blood groupism in man; Sex determination in man.

6 hrs.

**Module - 6: Plant Biotechnology**

Tissue culture - Principle and procedure; Transgenic plants: Scope and applications, BT Cotton, BT Brinjal, Golden Rice; Bioreactors and their significance. 6hrs.

**Module - 7 Environmental Science**

Ecosystem: Structure - Abiotic and Biotic Factors, Ecosystem:, Types of plant interactions; Mutualism, Commensalism, Predation, Symbiosis, Parasitism, Competition. Biodiversity, Conservation, *In situ* and *Ex situ* methods, National Parks, Sanctuaries, IUCN, Threat Categories, Red list. Green House Effect, Ozone depletion, Deforestation and Reforestation, Alternative energy resources, Sustainable development and Utilization of resources.

12 hrs.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

**OPEN COURSE - Choice - 2: APPLIED BOTANY**
**Code: BOT5D01**

Total – 54 hrs.

MODULE –I PLANT PROPAGATION

1. Seed propagation – Seed dormancy, seed treatment, conditions for successful propagation, rising of seed beds, care of seedling, transplanting techniques.
2. Vegetative propagation:
   (a) Cutting (stem, roots)
   (b) Grafting (approach, cleft)
   (c) Budding (T-budding, patch)
   (d) Layering (simple, air)
3. Micro propagation- General account 12 hrs.

MODULE - II STEPS OF GROWING PLANTS

1. Soil- Composition, Types, Texture, Soil pH, Correcting pH, Humus
2. Pots & Potting – Earthen, Fibre, Polythene bags, Potting mixture, Potting, Depotting, Repotting.
2. Chemical fertilizers: types, application, merits and demerits
3. Organic manure; types, application, merts and demarits
4. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers.
5. Plant protection: Biological, Physical and mechanical, Chemical, biopestcide

12 hrs.

MODULE – III. BOTANY IN EVERY DAY LIFE

1. Vegetable gardening
1. Mushroom cultivation
2. Vermi composting- technique
3. Biofertlizer Technology
4. Orchid and Anthurium cultivation
5. Creating Bonsai 20 hrs.

MODULE – IV. ECONOMIC BOTANY

1. General account on various plants of economic importance
2. Study the Binomial, Family, Morphology of the useful part of the following plants.

1. Cereals and Millets – Rice, Wheat
2. Pulses –Green gram, Bengal gram, Black gram
3. Beverages – Coffee, Tea, Cocoa.
4. Fibre – Coir, Cotton
5. Timber – Teak, Rose wood, Jack
6. Spices – Pepper, Ginger, Cardamom
7. Medicinal – Adhatoda, Phyllanthus, Rauvolfia
8. Oil- coconut, Gingelly
9. Ornamental plants of economic importance – Rose, jasmine
10. Fruit – Mango, Banana 10 hrs.

References

Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.

Andiance and Brison. 1971. Propagation Horticultural Plants.

Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.

Katyal, S.C., Vegetable growing in India, Oxford, New York.

Naik, K.C., South Indian Fruits and their Culture.

Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.

Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.

George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.

Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.

Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India), Jodhpur.

Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.

Bal, J.S., Fruit growing, Kalyani Publishers, Delhi.

Rodgran, M.K. Plant Tissue Culture, Oxford & IBH Publishing Ltd., New Delhi.

Dr. S. Nesamony, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.

Dr. R. Prakash, Dr. K. Raj Mohan, Jaivakrishi (Organic farming), State Institute of Languages, Trivandrum.

Hudson, T. Hartmann, Dale K. Kester, Fred T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

**OPEN COURSE-Choice -3: BASIC TISSUE CULTURE**
**Code: BOT5D01**

Total – 54 hrs.

Module - I .

1. Introduction; Aims and objectives of Plant Tissue Culture.
2. Organization and facilities of a Tissue culture Laboratory.
3. Equipments and apparatus in a tissue culture lab.
4. Sterilization techniques – Autoclaving Flame sterilization, UV irradiation,, Chemical sterilization. Sterilization of instruments and glass wares, medium, explants 7 hrs

Module-II

1. Plant tissue culture – Principles and techniques: Cellular totipotency, in vitro differentiation –de differentiation and re-differentiation,.
2. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium – suspension culture. Murashige and Skoog medium – composition and preparation.
3. Aseptic techniques in tissue culture - preparation of explants – surface sterilization. Inoculation, incubation and subculturing. 10 hrs.

Module-III

1. Micro propagation - Different methods – axillary bud proliferation, direct and Indirect organogenesis and somatic embryogenesis.

2. Different phases of micro propagation – hardening, transplantation and field

Evaluation: Advantages and disadvantages of micro propagation.

Soma clonal variation. 10 hrs.

Module – IV

1. Applications of plant tissue culture: Micro propagation; Somatic embryogenesis; Artificial seeds, Germplasm conservation, Embryo rescue culture, Protoplast isolation, culture and fusion, Anther, pollen and Ovary culture for production of haploids, Cryopreservation. Shoot apical meristem culture and production of pathogen free stocks and somaclonal variation.

20 hrs.

MODULE –V

Transformation technology – Transgenic plant production, Gene transfer methods in plants, Multiple gene transfers, Vector less or direct gene transfer techniques. 7 hrs

**References**

Dixon, R.A. & R.A. Gonzales. 1994. Plant Cell Culture – A Practical Approach (2nd Ed) Oxford University Press.

Mantel & Smith (1983) Plant Biotechnology. Cambridge University Press

Mantel, S. H, Mathew, J.A. et al. 1985 An introduction to Genetic Engineering in plants. Blackwell Scientific Publishers, London.

Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.

Hammond, J., Megary, P et al. 2000. Plant Biotechnology. Springerverlag.

Gamborg, O.L. & G.C. Philips (Eds.) 1995. Plant Cell, Tissue and Organ Culture Fundamental Methods. Narosa Pulishing House, New Delhi.

Reinert & Bajaj Plant Cell, Tissue and Organ Culture.

Das, H.K. (Ed) 2005. Text book of Biotechnology (2nd ed) Wiley India (Pvt.) Ltd. New Delhi.

## SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE- 8: PHYSIOLOGY AND BIOCHEMISTRY

### Code: BOT6B08T

Total: 126 hrs.

### PHYSIOLOGY

Total: 63 hrs. [3½ hrs. per week]

MODULE - 1.

1. Plant cell and Water

   Properties of water; water as a solvent; cohesion and adhesion. Diffusion, osmosis, osmotic pressure, concept of water potential, components of water potential, osmotic potential, turgor pressure, imbibition, matric potential.

2. Transpiration. Types and process. Mechanism of guard cell movement. $K^+$ ion mechanism. Why transpiration? Anti transpirants.
3. Absorption of water by transpiration pull and cohesion of water molecules. Radial movement of water through root. Soil-plant-atmosphere continuum of water. 18 hrs

Module-II

1. The ascent of sap; Transpiration pull and cohesion of water molecules. Merits and demerits of cohesion-tension theory.

2. Plants and inorganic nutrients. Macro and Micro nutrients. Uptake of mineral elements. Difference between passive uptake and active uptake.

Simple and facilitated diffusion. Active uptake. Carrier concept. Evidences.

15 hrs.

Module - III

1. Photosynthesis in higher plants: Photosynthetic apparatus. Electromagnetic radiation. Absorption of light. Fluorescence and phosphorescene. Organization of light harvesting antenna pigments. Photochemical and chemical phases of photosynthesis and its evidences. Red drop and Emerson enhancement effect. Two pigment systems, components. Redox potentials of the electron carriers. Photosynthetic electron transport and photophosphorylation. Assimilatory powers- ATP and NADPH. Photosynthetic carbon reduction cycle (PCR), RUBISCO, C3. C4, and CAM pathways. Ecological significance of C4, and CAM metabolism. Photorespiration. Law of limiting factors. 12 hrs.
2. Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of Nitrogen fixation. Export of fixed nitrogen from nodules. Genetics of nitrogen fixation, Ammonia assimilation, assimilation of nitrate. Biosynthesis of amino acids reductive amination and transamination. 5 hrs.
3. Translocation and distribution of photo assimilates. Composition of phloem exudates. Mechanism of phloem transport. Phloem loading and unloading; pressure flow hypothesis. 5 hrs.

**Module - IV**

1. Plant growth and development. Auxins, gibberellins, cytokinins, abscisic acid and ethylene, their physiological roles. Photoperiodism and vernalization.
2. Plant movements -Phototropism, gravitropism. Nyctinastic and seismonatic movements.
3. Photomorphogenesis: Phytochrome: chemistry and physiological effects.
4. Seed dormancy and germination. 8 hrs.

**Practicals**

18 hrs.

Students should familiarize experiments and details must be recorded. Any of the experiment can be asked to demonstrate in the practical examination

1. Determination of water potential by tissue weight change method.
2. Determination of stomatal index.
3. Relation between water absorption and transpiration.
4. Separation of leaf pigments by paper chromatography/ column chromatography/TLC.
5. Effects of light intensity on photosynthesis by Wilmot's bubbler.
6. Thistle funnel osmoscope
7. Ganong's Potometer
8. Ganong's light-screen
9. Ganong's respirometer
10. Kuhne's fermentation vessel
11. Mohl's half-leaf experiment
12. Experiment to demonstrate suction due to transpiration
13. Demonstration of gravitropism using Klinostat.

References

1. William G. l-lopkins,(1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.
2. Lincoln Taiz and Eduardo Zeiger (2002). Plant Physiology 2nd edition. Sinauer Associates, Inc.Publishers. Sunderland, Massachusetts.
3. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.

4. G. Ray Noggle and George J.Fritz Introductory Plant Physiology Prentice Hall.

5. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

## BIOCHEMISTRY

Total: 63 Hrs. [3 1/2 hrs. per week]

1. Macromolecules-building block biomolecules - metabolic intermediates-precursors).
2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates.
3. Lipids. Classification. Complex lipids, Simple lipids and derived lipids; Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids.
4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; zwitterions, Dipeptides
5. Proteins: Primary, secondary, tertiary and quarternry structures of proteins. Native comformation and biological functions of proteins. Denaturation and renaturation.
6. Nucleotides structure of nucleotides. Functions of nucleotides and nucleotide derivatives.
7. Secondary metabolites. A brief account of secondary metabolites, physiological roles. Significance: ecological importance.
8. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, covalentty modulated enzymes. Isoenzymes.
9. Intermediary metabolism: Anabolism, catabolism, amphibolic pathways and anapleurotic reactions.
10. Catabolism of hexoses. Glycolysis: Two phases of glycolysis. Overall balance sheet. Fate of pyruvate under aerobic and anaerobic conditions. Citric acid cycle:

Formation of acetate, Reaction of citric acid cycle, Anapleurotic reactions of citric acid cycle. Amphibolic nature of citric acid cycle.

11. Oxidation of fatty acids. β oxidation of saturated fatty acids in plants. Glyoxylate cycle.
12. Biosynthesis of saturated fatty acids in plants. Involvement of fatty acid synthase complex and acyl carrier protein.
13. Oxidation of amino acids and entry to TCA cycle.
14. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers function as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis. Shuttle systems.

**PRACTICALS**

1. Qualitative tests for monosaccharides, and reducing non reducing oligosaccharides, starch, amino acids and protein.

a. Molisch's test for all carbohydrates
b. Benedict's test for reducing sugars
c. Barfoed's test for monosaccharides
d. Seliwanoff's test for ketoses
e. Fearson's test (methyl amine test) for reducing disaccharides
f. Iodine test for starch
g. Ninhydrin test for amino acids and protein
h. Xanthoproteic test for amino acids with aromatic R-groups
i. Biuret test for peptide linkage and proteins

2. Demonstration of quantitative estimation of protein by Biuret method.

3. Demonstration of quantitative estimation of DNA and RNA by colorimetric / spectrophotometric method.

4. Colorimetric estimation of reducing sugars in germinating seeds.

**References:**


1. David L; Nelson and Michael M Cox (2000).Lehninger. Principles of Biochemistry. 3rd edition. Macmillon, Worth U.K.
2. Geoffrey Zubay Biochemistry Macmillen Publishing Company, Newyork
3. David T. Plummer, An Introduction to Practical Biochemistry. Tata Mc Grow Hill.
4. Sadasivam and Manickam, Biochemical methods. New Age International Publishers. New Delhi.
5. Secondary plant products, vol.8. Encyclopedia of Plant Physiology, 1980, Springer – Verlag, Berlin (This book is available in the library of Department of Botany, University of Calicut).
6. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.
7. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.
8. Keith Wilson and John Walker.( 2008). Principles and techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.
9. Trevor Palmer. Enzymes- Biochemistry, Biotechnology and Clinical Chemistry. Norwood Publishing, Chichester.
10. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.


**SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME**

## CORE COURSE-9: CELL BIOLOGY, GENETICS AND PLANT BREEDING

**Code: BOT6B09T**

[Total: 126 hours]

**CELL BIOLOGY**

Total: 36 hrs. [2 hr. per week]

**Module – I.**

1. Architecture of cells. Prokaryotic and Eukaryotic cells. 1 hr.

2. Structure and function of the following:

    a. Cell membrane (fluid mosaic model),

    b. Endoplasmic reticulum,

    c. Golgi complex,

    d. mitochondria

    e. chloroplast,

    f. Lysosomes

    g. Glyoxisomes

    h. Ribosomes

    i. Cytoskeleton

    j. Cytosol

    l. Vacuole 4 hrs.

3. Nucleus - Nuclear membrane; Nuclear pore complex; organization of interphase Nucleus; Euchromatin and heterochromatin; Nucleolus. 2 hrs.

4. Chromosomes - Morphology, classification, Centromere and Telomere, Chemical Composition and organization. 2 hrs.

**Module-II**

1. Special types of chromosomes –Polytene chromosomes, lampbrush chromosomes

2. Cell division - cell cycle - Mitosis & Meiosis – significance- molecular control of cell division

3. Chromosomal changes - structural aberrations: deletion, duplication, inversion, translocation - their meoitic consequences and significance

4. Numerical aberration - Defintion - Basic chromosome number (Genomic Number) Aneuploidy, Haploidy and Polyploidy - their meiotic behaviour and significance.

12 hrs.

PRACTICALS

[Total; 6 hrs.]

1. Mitosis - Acetocarmine squash preparation of Onion root tip.

2. Calculation of mitotic index

3. Demonstration of meiosis in Rhoeo/Chlorophytum/ Maize Identification of different stages of Meiosis.

**Reference**


1. Arumugham. N. Cell Biology. Sara Publication, Nagercoil.
2. Avinash Upadhyaya & Kakoli Upadhayayo 2005. Basic Molecular Biology. Himalaya Publishers.
3. De Robertis. E.D.P., & De Robertis E.M.S. 1998 Cell and Molecular Biology - Lea & Febiger.
4. Geoffery M. Cooper & Robert E. Haufman. 2007. The cell - a molecular approach. A.S.S. Press Washington, U.S.A.
5. Lewis. J. Kleinsmith & Valerie M. Kish 1995. Principles of Cell & Molecular Biology.
6. Lewin B. Genes VII. Oxford University press.
7. Lodish. H. et. al., 2000. Molecular Cell Biology, Freeman & Company.
8. Powar C.B. 1988. Essentials of Cytology, Himalaya Publishing House.
9. Rastogi S.G. Cell Biology. Tata Mc Graw Hill Publishing Company New Delhi
10. Rastogi. V.B. 2008. Fundamentals of Molecular Biology, Ane Books India.

# GENETICS

Theory: 54 hrs.

## Module - I

1. Introduction- Brief account of Mendel's life history: Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance; Back cross, test cross. 5 hrs.
2. Modified Mendelian ratios:
   a. Allelic interactions: dominant – recessive, Incomplete dominance - flower color in Mirabilis; Co dominance – Coat colour in cattle, Blood group in human beings; Lethal genes – Sickle cell anaemea in Human beings.
   b. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry (9:3:3:1): Epistasis: dominant - Fruit colour in summer squashes; recessive epistasis - Coat color in mice; Complementary gene interaction- flower color in Lathyrus . 5 hrs.

3. Multiple alleles- general account: ABO blood group in man, self sterility in Nicotiana, Coat colour in Rabbits. 2 hrs.

4. Quantitative inheritance / polygenic inheritance / continuous variation- Skin color in human beings, ear size in maize. 2 hrs.

## Module -II

1. Linkage and crossing over- importance of linkage, linkage and independent assortment. Complete and incomplete linkage. Crossing over- general account, 2 point and 3 – point crossing over, cytological evidence of genetic crossing over. Determination of gene sequences; interference and coincidence; mapping of chromosomes. 5 hrs.

2. Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (Melandrium album); genic balance theory of sex determination in Drosophila; sex chromosomal abnormalities in man. 3 hrs.

3. Sex linked inheritance: X-linked, Y-linked; Eye color in Drosophila, Haemophilia in man; Y-linked inheritance; Sex limited inheritance. 3 hrs.
4. Extra nuclear inheritance- general account- maternal influence- plastid inheritance in Mirabilis, Shell coiling in snails. 3 hrs.
5. Population genetics; Hardy – Weinberg law and equation 2 hrs.

**PRACTICAL**

Total: 24 hours.

1. Students are expected to work out problems related to the theory syllabus and recorded.
   a. Monohybrid cross
   b. Dihybrid cross
   c. Test cross and back cross
   d. Determination of genotypic and phenotypic ratios and genotype of parents
   e. Non epistasis
   f. Complementary gene interaction
   g. Epitasis: dominant and recessive
   h. Polygenic interaction
   i. Multiple allelism
   j. Chromosome mapping
   k. Calculation of coincidence and interference

Reference:

1. Gunther, S. Spend & Richard Calender 1986 - Molecular Genetics CBS Publishers - Delhi.
2. Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut.

3. John Ringo 2004- Fundamental Genetics Cambridge University Press.
3 Lewin B 2000 Genes VII Oxford University Press.
4 RastogiV.B. 2008, Fundamentals of Molecular Biology, Ane Books, India.
6. Sinnot, W.L.C. Dunn & J. Dobzhansky 1996. Principles of Genetics. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
7. Taylor, D.J., Green, N.P.O. and Stout, G.W. Biological Science 3rd edn. Cambridge University Press.
8. Verma, P.S. & Agarwal 1999. Text book of Genetics. S. Chand & Co., New Delhi.

## PLANT BREEDING

Total: 36 hrs. [2hrs. per week)

**Module-I**

1. Definition and objectives of Plant breeding – Organization of ICAR and its role in plant breeding. 1 hr.

2. Plant Genetic Resources - Components of Plant Genetic Resources. 1 hr.

**Module-II**

3. Breeding techniques -

   a. Plant introduction: Procedure, quarantine regulations, acclimatization-agencies of plant introduction in India, major achievements

   b. Selection - mass selection, pureline selection and clonal selection, genetic basis of selection, significance and achievements.

   c. Hybridization – procedure; intergeneric, interspecific and intervarietal hybridization with examples; composite and synthetic varieties .

   c. Heterosis breeding - genetics of heterosis and inbreeding depression

d. Mutation breeding – methods,- achievements.

e. Polyploidy breeding

f. Breeding for disease and stress resistance 20 hrs.

4. Modern tools for plant breeding: Genetic Engineering and products of genetically modified crops (brief mentioning only). 2 hrs.

**PRACTICAL**

1. Techniques of emasculation and hybridization of any bisexual flower.
2. Floral biology of Paddy, any one Pulse and Coconut tree.

References


1. Allard. R.W. 1960. Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.
3. Singh, B.D. 2005. Plant Breeding - Principles & methods , Kalyani Publishers, New Delhi.
4. Sinha U. & Sunitha Sinha 2000 - Cytogenetics, Plant breeding & Evolution, Vikas Publishing House.
5. Swaminathan, Gupta & Sinha - Cytogenetics of Crop plants


SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE-10: ENVIRONMENTAL SCIENCE, PHYTOGEOGRAPHY AND EVOLUTION

Code: BOT6B10T

[Total: 126 hours]

**ENVIRONMENTAL SCIENCE**

Theory-54 Hrs. [3hrs. per week]

Module - 1

1. Ecosystem – Definition ; abiotic and biotic factors; trophic structure; Food chain and food web; Eecological pyramids; Energy flow; Productivity of ecosystems.
2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous)
3. Plant adaptations: Adaptations in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.
4. Plant Succession: Definition – Primary and Secondary succession; Autogenic and allogenic succession; Mechanism of plant succession– Xerosere and Hydrosere 15 hrs.

**Module-II**

1. Biodiversity and Conservation: Definition; Biodiversity - Global and Indian Scenario; Megadiversity nations and hotspots: Biosphere reserves; Biodiversity centres in India.
2. Threats to biodiversity; Endangered and endemic plant species – Red data book - Exotic and indigenous plant species – Keystone species – Flagship species.
3. Conservation strategies ex situ and in situ methods. Organizations – IUCN, UNEP & WWF; (NBPGR) Biodiversity Board of Kerala (KSBDB). 10 hrs.

Module-III

1. Pollution: Sources and types of pollution – air, water, soil, thermal and noise; biodegradable and non-biodegradable pollutants; biomagnifications; BOD.

2. Global environmental changes – climatic changes – global warming and greenhouse gases – acid rains – el-nino – Efforts of world organizations in the regulation of green house gases emission.
3. Management of environmental pollution – conventional and phytotechnological approaches – solid wastes management including e-wastes-environmental legislations in India (Prevention and Control of Pollution act, 1981). 15 hrs.

Module- IV

1. Major ecosystems of the Biosphere; Sea; Estuarine ecosystem; Lentic ecosystem: lake, Pond; Lotic ecosystem: river; Desert; Forest; grass land.
2. Techniques in plant community studies – Quadrat and transect methods – species area curve – density, frequency, abundance, dominance of populations – importance value index – construction of phytographs. 14 hrs.

**PRACTICALS**

[Total: 18 Hrs.]

1. Construct a food web from the given set of data, (Representative of a natural ecosystem).
2. Construct ecological pyramids of number, biomass, energy from the given set of data, (Representative of a natural ecosystem).
3. Study of plant communities – Determination of density, abundance, dominance, frequency by quadrat method.
4. Demonstration of determination of Dissolved Oxygen by Winkler's method.
5. Study of morphological and anatomical characteristics of plant groups – Hydrophytes, Xerophytes, halophytes, epiphytes, parasites.

References

1. Ahluvalia V.K. Malhotra S. 2009. Environmental Science. Ane Books – New Delhi.

2. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co.Varanasi.

3. Beeby A. & Brennan A.M. First Ecology. Ecological Principles and Environmental Issues. International Student Edition.

4. Benon E. Plant Conservation Biotechnology. Taylor & Francis Ltd. II New Felter Lane, London. EC4P4EE.

5. Cunninghan W.P. and M.A. Cunningham 2003. Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.

6. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.

7. Dix J.H. 1989. Environmental Pollution. Atmosphere, Land, Water and Noise. Wiley Chichester.

8. Khitoliya R.K. 2007. Environmental Pollution – Management and Control for Sustainable development S. Chand and Company Ltd., New Delhi.

9. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.

10. Michael S. 1996. Ecology. Oxford University Press, London.

11. Mishra D.D 2008. Fundamental Concepts in Environmental Studies. S. Chand & Co., New Delhi.

12. Mishra S.P. & S.N. Pandey 2008. Essential Environmental Studies. Ane Books Pvt. Ltd. Thiruvananthapuram.

13. Odum E.P. 1983. Basics of Ecology. Saunders International UN Edition.

14. Shukla R.S. & P.S. Chandel 2005. A Text Book of Plant Ecology S. Chand & Co. Ltd. New Delhi.

15. Wise D.L. 2005. Global Environmental Biotechnology. Ane Books. Trivandrum.

16. Bharucha E. 2005. Text Book of Environmental Studies for UG courses. University Press (India) Private Limited Hyderabad.

17. Archibold. O.W. 1995. Ecology of World Vegetation. Chapman & Hall, London.

18. Diamond, J., T.J. Case 1986. Community ecology. Harper & Row, New York.

19. Futuyma P.J., Slatkin M. 1983. Co-evolution. Sinauer Associates, Sunderland, Mass.

20. Krebs, C.J. 1985. Ecology 3rd edn. Harper & Row New York.

21. Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.

22. Shukla R S & P.S. Chandal 2008: Ecology and utility of plants' S. Chand & Company Ltd. New Delhi.

**PHYTOGEOGRAPHY**

Theory: 18 hrs.

PHYTOGEOGRAPHY

1. Definition, concept, scope and significance of phytogeography. 2 hrs.

2. Patterns of plant distribution - continuous distribution and discontinuous distribution, vicarism, migration and extinction 4 hrs.

3. Continental drift, evidences and impact. 2 hrs.

4. Glaciation: causes and consequences. 2 hrs.

5. Theory of land bridges. 2 hrs.

6. Endemic distribution, theories on endemism, age and area hypothesis. 3 hrs.

7. Phytogeographical zones (phytochoria) of the world and India. 3 hrs.

**PRACTICALS** (9 hrs.)

1. Draw the phytogeogrphic zones of the world.
2. Draw the phytogeographic zones of India.

Reference

1. Ronald Good, 1947. The Geography of Flowering Plants. Longmans, Green and Co, New York
2. Armen Takhtajan, 1986. Floristic Regions of the World. (translated by T.J. Crovello & A. Cronquist). University of California Press, Berkeley.
3. P. D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerut

## EVOLUTION

Total: 27 hrs.

### Module - I

1. Origin of Earth – Introduction; Evidences of organic evolution; Evidences from Morphology, Anatomy, Embryology, Palynology, Genetics and Molecular Biology. 6 hrs.
2. Condensation and Polymerisation; Protenoids and Prions – Oparin concept; Miller's experiment. 3 hrs.
3. Evolution of prokaryotic and eukaryotic cells. Archaebacteria – Early fossilized cells. 2 hrs.
4. Theories on origin and evolution of species: Spontaneous generation; Lamarckism; Darwinism; Weismann and deVries; Neo-Darwinism and its objection; Arguments and support for Darwinism. 7 hrs.
4. Genetic Constancy and Creation of Variability : Cell divisions and genetic constancy; – Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift. 6 hrs.
6. Speciation: Isolating mechanism – Modes of speciation – sympatric and allopatric. 3 hrs.

References


1. Crick F., 1981. Life itself: Its origin and Nature. Simon and Schuster, New York.
2. Drake J.W., 1970. The molecular basis of mutation. Holden – Day – San Francisco.
3. Dott R.H., R.L. Batten, 1981. Evolution of the earth 3rd edn. McGraw Hill New York.
4. Fox S.W. and K. Dose, 1972. Molecular evolution and the origin of life. W.H. Freeman & Co., San Francisco.
5. Gould S.J. 1977. Ontogeny and Phylogeny. Harvard Univ. Press, Cambridge, Mass.
6. Jardine N., D.Mc Kenzie, 1972. Continental drift and the dispersal and evolution of organisms. Nature, 234. 20-24.
7. Miller, S.L. 1953. A production of aminoacids under possible primitive earth conditions. Sceicne, 117., 528-529.
8. Strickberger, 1990. Evolution, Jones and Bastlett Publishers International, England.

# ELECTIVE PAPERS

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

**CORE COURSE-11: Elective-1: GENETIC ENGINEERING**

**Code: BOT6B11T**

[Total: 126 hrs. Theory 90 hrs. , Practical: 36 hours]

**Module -I**

Introduction to gene cloning

1. DNA isolation; DNA isolation solutions, isolation buffer pH, concentration and ionic strength, DNase inhibitors, detergents used for isolation, methods for breaking the cells
2. Removal of proteins from cell homogenate; using organic solvents, Kirby method and Marmur method, using CTAB
3. Removal of RNA; using RNase A, RNase T1
4. Concentrating the isolated DNA; precipitating with alcohols, salts added along with alcohol
5. Determination of the concentration and purity of DNA; using UV spectrophotometry
6. Storage of DNA samples
7. Commercially available kits for genomic and plasmid DNA isolation
8. Preparation of genomic DNA from animal cells, plant cells and bacterial cells; protocol for small scale and large scale preparations
9. Isolation of plasmid DNA; protocol for small scale and large scale preparations
10. Isolation and purification of RNA; purification of total RNA, RNase inhibitors, preparation of cell material, preparation of glass wares, guanidinium hot phenol method, high salt lithium chloride method, isolation of poly A RNA

20 hrs

Module-II

Agarose Gel electrophoresis of DNA and RNA

1. Principles of electrophoresis,
2. Buffers used for electrophoresis of nucleic acids,
3. Gel concentration, sample concentration, sample loading solutions,

4. Gel staining,
5. Determination of molecular weight using molecular weight markers, special precautions and treatments required for electrophoresis of RNA,
6. Elution of DNA from agarose gels; electroelution, using low-melting point agarose,
7. Nucleic acid transfer and hybridization; Southern blot transfer, dot-blot transfer, plaque and colony transfer, Southern blot hybridization, Northern blot transfer and hybridization, in situ hybridization
8. Preparation of probes for hybridization, radioactive labeling, digoxigenin labeling, nick translation, preparation of primer using PCR, RNA probes

25 hrs.

Module - III

Principle of DNA cloning

1. Cloning vectors; essential features of a cloning vector, plasmid derived vectors , bacteriophage derived vectors, hybrid vectors, high capacity cloning vectors; BACs, PACs and YACs , Agrobacterium based vectors, shuttle vectors, expression vectors
2. Enzymes used in recombinant DNA technology; type II restriction endonucleases, ligases, S1 nuclease, alkaline phosphatase, terminal transferase, DNA polymerase I, reverse transcriptase, exonuclease III, bacteriophages λ exonuclease,
3. Finding gene of interest; shot gun cloning followed by screening, construction and use of genomic DNA library and cDNA library, screening DNA libraries, chromosome walking, in silico gene discovery, cloning of the gene of interest, altering the gene of interest through site directed mutagenesis,
4. Preparation of recombinant DNA molecule, blunt ends and sticky ends, using tailing method, using polylinkers

5. Methods to transfer the recombinant DNA molecule into the cloning host; transformation, transfection, transduction, electroporation, microinjection, microprojectiles and DNA gun, Agrobacterium mediated transfer
6. Methods to select the recombinants; antibiotic markers, insertional inactivation, replica plating, blue-white selection, use of reporter genes; GUS, luciferase and GFP genes

25 hrs.

**Module -IV**

Transgenesis; introduction to transgenic organisms and their applications.

1. Mechanism of gene transfer into eukaryotic cells, transfection methods; using polyethelene glycol, chemical transfection using lithium acetate, calcium phosphate, and DEAE-dextran, lipofection, electroporation, microinjection, DNA gun, fate of DNA transferred to eukaryotic cells, random integration transgenesis – gain of function effects and loss of function effects, gene targeting,
2. Examples of transgenic crop plants and animals
3. Antisense and RNAi technology
4. Production of knock out models and their use
5. Applications of recombinant DNA tecnology
6. Ethical, Social and legal issues associated with recombinant DNA technology

20 hrs.

**Practical**: 36 hours

Students should be given sufficient exposure to the experiments listed below either by visiting nearby biotechnology labs or showing video clippings of the same. Centers opting this elective should procure the facilities required in the meantime.

Protocols of the listed experiments should be recorded.

1. Isolation of genomic DNA from plants and its quantification and purity checking using spectrophotometric method
2. Agarose gel electrophoresis of the isolated plant genomic DNA , its visualization and photography
3. Isolation of plasmid DNA from bacterium, and its quantification and purity checking using spectrophotometric method
4. Agarose gel electrophoresis of the isolated plasmid DNA , its visualization and photography
5. Preparation of competent E.coli cells
6. Preparation of recombinant plasmids , transformation of E.coli and selection of transformants

**References:-**


1. Recombinant DNA , JD Watson, 1992, Scientific American Books
2. Recombinant DNA: genes and genomes – a short course, JD Watson et al., 2006, WH Freeman & Co.
3. Recombinant DNA technology and applications, Alex Prokop et al., 1997, McGraw Hill
4. Principles of Gene Manipulation: An Introduction to Genetic Engineering, by R.W. Old and S.B. Primrose, 2000, Blackwell Scientific
5. Molecular Cloning: a Laboratory Manual.. Sambrook J, Russel DW & Maniatis T. 2001, Cold Spring Harbour Laboratory Press.

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE-11: ELECTIVE-2: ADVANCES IN ANGIOSPERM SYSTEMATICS

Code: BOT6B11T

[Total: 126 hrs. Theory 90 hrs. , Practical: 36 hours]

**Module -I** Principles of Angiosperm Taxonomy

1. Scope and importance of Taxonomy.
2. The development of taxonomy- Ancient classification; The herbalists; Early taxonomists; Linnaeus; Post Linnaean natural systems; Post Darwinian phylogenic; Modern Phenetic methods (Numerical taxonomy); Modern Phylogenic methods (Cladistics). APG system of classification
3. Problems in Evolutionary Taxonomy: Deducing phylogenic relationship; The concept of primitive and advanced; monophyly and polyphyly; parallelism and convergence; Homology and analogy; presentation of phylogenic relationship. 10 hrs.

Module-II The material basis of Systematics

1. Concept of character; Correlation of characters; character weighting; Character variation, isolation and speciation
2. Sources of Taxonomic characters: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Molecular Taxonomy. Role of the above mentioned branches in taxonomic studies
3. Identification techniques: Taxonomic literature: Flora, Revision, monograph. Use and construction of taxonomic keys. Herbarium: Definition, Steps involved in preparation and maintenance of herbarium, Herbarium consultation; General account of Regional and National herbaria with special emphasis to Kew, CAL, MH, CALI.
4. Botanic gardens and their importance in taxonomic studies – Important

National and International Botanic Gardens – Royal Botanic Gardens, Kew; Indian Botanic Gardens, Calcutta; National Botanic Garden, Lucknow; Tropical Botanic Garden, Trivandrum; Malabar Botanic Garden, Calicut

14 hrs.

**Module – III** Plant Nomenclature

1. History of nomenclature – Polynomial and binomial systems
2. Brief outline of ICBN
3. Major rules; Typification; Rule of priority; Effective and valid publication; author citation
4. Biocode, Phylocode 10 hrs.

**Module – IV** Taxonomic review of selected families

1. Critical study of the following families with emphasis on identification of local members using flora, economic importance, inter relationships and evolutionary trends: Nymphaceae, Capparidaceae, Sterculiaceae, Rutaceae, Meliaceae, Combretaceae, Myrtaceae, Lythraceae, Apocynaceae, Scrophulariaceae, Convolvulaceae, Bignoniaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Urticaceae, Amaryllidaceae, Arecaceae, Poaceae

20 hrs

Practicals:36 hrs.

1. Identification of locally available plants belong to the families mentioned under module - IV using flora.
2. Familiarize local flora and study the preparation of taxonomic keys and taxon card for plants coming under the families in module IV.
3. Students must critically study minimum 15 members of the plants under the families in module IV, make suitable sketches, prepare the taxon card and

key to identification of these members and submit as a report for the practical examination

References


1. Heywood, V H & Moore, D M. (Eds) 1984. Current concepts in Plant Taxonomy
2. Lawrance, G H M. Taxonomy of vascular plants. Oxford & IBH
3. Sivarajan, V V. 1991. Introduction to principles of plant Taxonomy. Oxford & IBH.
4. Vasishta, P C. Taxonomy of Angiosperms. R. Chand & Co. New Delhi.
5. Singh, V & D K Jain. 1997. Taxonomy of Angiosperms. RAstogi Publications, Meerut.
6. Stace, C A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London
7. Henry & Chandrabose.1997. An aid to International code of Botanical Nomenclature. BSI.


SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

## CORE COURSE-11: Elective-3 : GENETICS AND CROP IMPROVEMENT

Code: BOT6B11T

[Total: 126 hrs. Theory 90 hrs. , Practical: 36 hours]

**Module -1.**

Crop genetics - General account of origin, genetic variability, floral biology, breeding techniques and achievements in: Rice, Coconut, Rubber, Arecanut, Cashew and Pepper 10 hrs

**Module –II**

1. Plant genetic resources - Definition; Classification of Plant Genetic Resources. A activities – Exploration, conservation, evaluation, documentation and utilization.
1. Agencies involved in plant genetic resources activities – NBPGR and IPGRI
2. International institutes for crop improvement – IRRI, ICRISAT,CIMMYT, IITA. Brief account on research activities and achievements of national institutes – IARI, CCMB, IISc, BARC, CPCRI, IISR, RRII, CTCRI, KFRI, JNTBGRI 20 hrs.

**Module- III**

1. Methods of crop Improvement **:** a. Plant introduction b. Selection - Principles, Selection of segregating populations, achievements c. Hybridization – Interspecific hybridization; intergeneric – achievements

Genetics of back crossing, Inbreeding, Inbreeding depression, Heterosis and Heterobeltiosis 8 hrs.

**MODULE IV.**

1. Heteroploidy in crop improvement – achievements and future prospects – Significance of haploids and polyploids
2. Mutations in crop improvement – achievements and future prospects
3. Genetics of nitrogen fixation – Use of biofertilizers in crop improvement
4. Genetics of photosynthesis 12 hrs.

**MODULE- V.**

**I. Breeding for resistance to abiotic and biotic stresses** – Introduction, importance of abiotic and biotic stresses and its characteristics

**a. Breeding for drought resistance** – Genetics of drought resistance; Breeding methods and approaches; Difficulties in breeding for drought resistance

**b. Breeding for mineral stress resistance** – Introduction – Salt affected soils – Management of salt affected soils: Salinity resistance – General account – Genetics of salinity resistance – Sources of salinity resistance – Breeding approaches – Problems in breeding for salinity resistance; Mineral stress resistance – General account – Resistance to mineral deficiency stress - Genetics of mineral deficiency resistance – Sources of mineral deficiency resistance

**c. Heat and cold resistance** 1. Heat stress – General account; Heat stress resistance - Genetics of heat tolerance – Sources of heat tolerance. 2. Chilling resistance – Chilling tolerance – Genetics of chilling tolerance – Sources of chilling tolerance; Problems in breeding for freezing tolerance

**20 hrs**

**B. Breeding for resistance to biotic stresses**

a. Disease resistance – History of breeding for disease resistance; Genetics of pathogenicity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance – Oligogenic, polygenic and cytoplasmic inheritance – Sources of disease resistance – Methods of breeding for disease resistance.

b. Insect resistance – Introduction, Mechanism, Nature and genetics of insect resistance – Oligogenic, Polygenic and cytoplasmic resistance – sources of insect resistance – Breeding methods for insect resistance – Problems in breeding for

insect resistance – Achievements – Breeding for resistance to parasitic weeds

**20 hrs.**

**Practicals** **36 hrs.**

**1**. Identification of major pests and diseases of crop plants by field identification. Submission of specimens related to pathology and crop improvement

2. Visit to a leading breeding station in South India and submission of study report

3. Demonstration of hybridization in Rice, Cashew and *Solanum*

4. Study of variability under induced stress (salinity and moisture) of seedlings of rice and green gram and submission of report

**References**


1. Singh, B D. 2000. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
2. Sharma, J R. 1994. Principles and Practice of Plant Breeding. Tata Mcgraw – Hill Publishing Company, New Delhi.
3. Benjamin Levin. 2007. Genes VIII.
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# MODEL QUESTIONS

## Core Course - I

## Model question- Subject wise distribution of marks

| Type of questions | Plant Anatomy | Total |
|---|---|---|
| 1 mark | 10 | 10x1=10 |
| 2 marks | 10 | 10x2=20 |
| 5 marks | 8 | 6x5 =30 |
| 10 marks | 3 | 2x10=20 |

## MODEL QUESTION PAPER

## CORE COURSE I – PLANT ANATOMY

**Time 3 Hours** **Max. 80 marks**

### Part-A

(Answer all questions)

1. Roughness of grass leaf is due to the presence of ----------
2. Vascular cambium is a ---------- meristem
3. Growth of cells wall is accomplished by
4. ---------- is a living mechanical tissue
5. Closed vascular bundle is present in ----------
6. Cork Cambium is also known as ----------
7. Type of stomata found in Ixora is ----------
8. Root cap is derived from ----------
9. Casparian strips occur in----------
10 Calcium carbonate crystals are found as ----------

(1x10=10marks)

## Part B

Answer all questions

11. Differentiate between simple and compound leaves
12. Comment on Endodermis
13. What are tyloses? Mention their function
14. What are annual rings?
15. Comment on boarded pits
16. Histogen theory
17. What are Hydathodes?
18. What is meant by leaf gaps?
19. Concentric bundles
20. Protxylem lacuna (2x10=20 marks)

## Part-C

Answer any six questions:

21. Give a detailed account of isobilateral leaf with the help of labelled sketch
22. What are lenticels? Mention their functions
23. What is the importance of wood anatomy?
24. Describe Root-stem transition in plants
25. Schizogenous and lysigenous ducts
26. Describe the various types of stomata with examples
27. Describe the structure of Xylem and phloem
28. Comment on extra cell wall materials

6x5 = 30 marks

## Part - D

Answer any three of the following

29. With the help of labeled diagrams, describe the anomalous secondary growth in Bignonia.
30. With the help of labeled diagrams, describe secondary growth in dicot root
31. Classy the tissues found in plants and list out their characters with suitable diagrams

2x10=20 marks

## Core Course - II

## Model question- Subject wise distribution of marks

| Type of questions | Mark distribution | | | |
|---|---|---|---|---|
| | Embryology | Palynology | Horticulture | Total |
| 1 mark | 3 | 3 | 6 | 10x1=10 |
| 2 marks | 2 | 2 | 6 | 10x2=20 |
| 5 marks | 2 | 2 | 4 | 6x5=30 |
| 10 marks | 1 | | 1 | 2x10=20 |

## MODEL QUESTION PAPER

## CORE COURSE II-EMBRYOLOGY, PALYNOLOGY AND HORTICULTURE

**Time 3 Hours** **Max. 80 marks**

### Part-A

(Answer all questions)

1. Name the anther wall layer with fibrous thickening
2. Sand is used in potting media to improve
3. Bone meal is an example of ---------- kind of manure
4. Name a nematode used in vermin composting
5. Olericulture deals with the study of----------
6. Name the type of ovule in which the funiculus surrounds the ovule.
7. Cotyledon of Monocot embryo is known as
8. Monothecous anthers are found in
9. Name a fern used as biofertlizer
10. Name a plant propagated by stem cutting

(1x10= 10 marks)

Part-B

Answer all questions

11. What are clones?
12. What is double fertilization?
13 What is CEC? How does it affect soil fertility?
14. Explain air layering.
15. Define Parthenocarpy
16. Discuss the role of synergids
17. Define Areo and Melitto palynolgy
18. Cpomment on endothelium
19. What is Pollenkit substance?
20. Account on Humus 10x2=20 marks

**Part-C**

Answer any six of the following;

21. Give the structure of a typical monocot embryo
22. Comment on the role of Palynology in Taxonomy
23. Describe the methods of Pollen viability tests
24. Comment on the causes and significance of Poly embryony
25. Give an account on indoor gardening
26. List out the scope of Horticulture
27. Describe different types of endosperm formation found among Angiosperms
28. Explain the methods of irrigation

6x5=30 marks

**Part D**

Answer any two- Essay type

29. Write an essay on methods of propagation in plants
30. Write an essay on Mushroom cultivation

31. With the help of diagrams describe the Cruciferad type of embryo development in angiosperms.

(2x10=20 marks)

## Core Course - III

### Model question- Subject wise distribution of marks

| Type of questions | Research Methodolgy | Microtechnique | Total |
|---|---|---|---|
| 1 mark | 6 | 4 | 10x1=10 |
| 2 marks | 6 | 4 | 10x2=20 |
| 5 marks | 4 | 2 | 6x5 =30 |
| 10 marks | 2 | 1 | 2x10=20 |

### MODEL QUESTION PAPER

### CORE COURSE III – RESEARCH METHODOLGY & MICROTECHNIQUE

Time 3 Hours Max: 80 marks

### Part-A

(Answer all the questions)

1. One molar solution contains ---------- gm solute/ litre
2. Name the principle based on the colorimetry performs.
3. Visible spectrum range from ---- nm to ------nm
4. In Paper chromatography the separation happens on the basis of ----------
5. Arrange in order: 1) Interpretation 2) Presentation of data
   3) Analysis 4) Collection of data
6. Median is ----------
7. Name a natural dye

8. Give the expansion of FAA

9. Name an adhesive used in microtechnique

10. Concentration of Commercial formalin is ---------- 10x1=10 marks

**Part B**

(Answer all questions)

11. Write short note on bar diagram

12. Write short note on presrvatives

13. What are the advantages of arithematic mean over median

14. Significance of sampling in a population.

15. Significance of range in measuring the variability

16. What is maceration?

17. Explain the role of ethyl alcohol in permanent slide preparation

18. Write a note on significance of staining.

19. Frequency polygon

20. Random sampling

10x2=20marks

**Part C**

(Answer any six of the following)

21. Explain the preparation of one molar solution of HCl

22. What is the principle involved in centrifugation

23. Describe Poisson distribution

24. What is the significance of random number table.

25. Calibration in microscopic measurement

26. Common killing and fixation fluids.

27. Give an account on the working of pH meter

28. Write down the mechanism of camera lucida

6 x 5= 30 marks

**Part D**

(Answer any two of the following)

29. Write an essay on different kinds of design of experiments

30. Explain the principle, working, types and advantages of Electron Microscope

31. write an essay on the conditions to be observed while writing a research report

2x10=20 marks

**Core course- IV**

**Model question- Subject wise distribution of marks**

| Type of questions | Micro.Biol | Phycol. | Mycology | Licheno logy | Pathology | Total |
|---|---|---|---|---|---|---|
| 1 mark | 3 | 3 | 2 | 1 | 1 | 10x1=10 |
| 2 marks | 3 | 3 | 1 | 1 | 2 | 10x2=20 |
| 5 marks | 2 | 2 | 1 | | 1 | 6x5 =30 |
| 10 marks | 1 | 1 | 1 | | | 2x10=20 |

**MODEL QUESTION PAPER**

**CORE COURSE IV – MICROBIOLOGY, PHYCOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY**

Time 3 Hours Total: 80 marks

**PART A**

Answer all the questions

1. A virion is ----------
1. Name a marine alga
2. Lichen grown on the trees are called
3. Quick wilt of Pepper is caused by
4. Male sex organ in Chara
5. Floridean Starch is the energy reservoir of the Class of algae ----------
6. Apothecium is the fruit body of ----------
7. Asexual reproductive structure in Lichen is ----------
8. Infective protein particle is called ----------
9. Give an example of a retro virus
10. Which bacterium obtain energy from the following reaction

$NO_2 + ½ O_2 \rightarrow NO_3 + energy$

10x1=10 marks

**Part B**

**Answer all questions**

11. Define Plakea
12. What is Nannandrium
13. Define facultative saprophyte
14. Write notes on symbiosis with an example
15. What is heteroecious fungus
16. Distinguish between smut and rust
17. Write notes on Rhizophere
18. Differentiate between isogamy and oogamy
19. What is isidium
20. What is mycoplasma? Name a disease caused by it.

10x2=20 marks

**Part C**

**Answer any three of the following**

21. Write a brief account of role of microbes in industry
22. Give a brief account of Gram staining
23. Enumerate the medicinal uses of algae
24. Enumerate the economic importance of Fungi
25. Briefly explain physiology of parasitism
26. Explain the reproduction in Volvox
27. Briefly explain industrial uses of microbes
28. Describe the gene transfer methods in bacteria

6x5= 30marks

**Part D**

**Answer any two of the following**

29. Briefly explain the life cycle of a facultative saprophyte with special emphasis on damping off of seedling
30. Explain the different life cycle you have studied in algae with examples.
31. Describe the structure and reproduction of Bacteriophage.

2x10= 20 marks

**Core Course- V**

**Model question- Subject wise distribution of marks**

| Type of questions | Pterido. | Bryol. | Gymno. | Paleobot | Total |
|---|---|---|---|---|---|
| 1 mark | 4 | 2 | 2 | 2 | 10x1=10 |
| 2 marks | 4 | 2 | 2 | 2 | 10x2=20 |
| 5 marks | 2 | 2 | 1 | 1 | 6x5 =30 |
| 10 marks | 2 | 1 | | | 2x10=20 |

**MODEL QUESTION PAPER**

**CORE COURSE – V: BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALEOBOTANY**

Time 3 Hours Max. 80 marks

**PART A**

Answer all the questions

1. Name a vascular cryptogams.
2. Stele of Pteris Rhizome
3. Name a plant with manoxylic wood
4. Name a famous Indian Palaentologist
5. Sporangium develops from a single initial cell is called ----------
6. Origin of Himalayan Mountain Ranges took place in ---------- era
7. Anthoceros is commonly known as ----------
8. Name a plant with Polystelic stem ----------
9. Name a gymnosperm which contains vessels in the xylem ----------
10. The nomenclature of fossil form genus for a stem is ……

**10 x 1 =10 marks**

**Part B**

**Answer all questions**

11. Stele in Marsilea rhizome

12. Ligule of selaginella
13. Medicinal importance of Bryophytes
14. Apospory
15. How lateral conduction takes place in Cycas leaflet?
16. Mesophyll tissue of pinus needle
17. Spore dispersal mechanism in Funaria
18. What is amber?
19. What are resurrection plants? Give example.
20. Primive characters of Riccia sporophyte.

10 x 2 = 20 marks

## PART C

**Answer any six of the following**

21. Compare the elaters of Equisetum and Anthoceros.
22. Write an account on economic Importance of Bryophytes.
23. Describe the process of fossilization
24. With the help of labelled diagram, describe the structure of Gnetum ovule.
25. Draw L.S. of Selaginella strobilus, label the parts and describe its structure.
26. Briefly explain the affinities of Pteridophytes with Bryophytes and Gymnosperms.
27. Write an account on angiosperm characters in Gnetum
28. Heterospory is the beginning of seed habit. Discuss

6x5=30 marks

## Part- D

**Answer any two of the following**

29. With the help of a neat labelled diagrams discuss the similarities and differences of the Gymnosperm ovules you have studied and add a note on their evolutionary trend.
30. Discuss the evolution of sporophytes in Bryophyta with the help of suitable examples
31. With necessary diagrams describe the stelar evolution in Pteridophytes.

2x10=20 marks

## Core Course – VI

## Model question- Subject wise distribution of marks

| Type of questions | Systematics | Morphology | Eco.Bot | Ethno. Bot | Total |
|---|---|---|---|---|---|
| 1 mark | 4 | 3 | 2 | 1 | 10x1=10 |
| 2 marks | 5 | 3 | 1 | 1 | 10x2=20 |
| 5 marks | 2 | 2 | 1 | 1 | 6x5 =30 |
| 10 marks | 2 | 1 | | | 2x10=20 |

## MODEL QUESTION PAPER

## CORE COURSE – VI: MORPHOLOGY, PLANT SYSTEMATICS, ECONOMIC BOTANY & ETHNOBOTANY

Time 3 Hours Total: 80 marks

PART A

Answer all the questions

1. Who is the father of Botany
2. Standard size of herbarium sheet
3. Binomials with identical generic and specific names is called ----------
4. Verticillaster inflorescence is found in ----------
5. The abbreviation of OUT stands for
6. Caryopsis is the fruit seen in the family
7. Colchicine is extracted from ----------
8. Binomial of the source plant of Cotton is ----------
9. Coir is obtained from
10. Major source of sugar is India is ----------

1 x 10= 10 marks

PART - B

Answer all questions

11. What is Holotype?
12. What is a Flora?
13. What is epigyny?
14. Write the salient features for Apocyanaceae
15. Mention the inflorescence of Asteraceae
16. Name the binomial of clove.
17. Name any two fibre yielding plant and their binomial
18. Define ethnobotany.
19. What is meant by Binomial nomenclature?
20. Name two plants of ethnobotanical significance

10 x 2=20 marks

PART - C

Answer any six of the following

21. Briefly describe taxonomic hierarchy
22. Briefly describe chemotaxonomy
23. Describe the diagnostic features of the family Lamiaceae
24. Mention the family, binomial and useful part of any three cereals.
25. Mention the family, binomial and useful part of gum Arabic, and Asafeotida.
25. Briefly describe South Indian Tribes

6 x 5 =30 marks

PART - D

Answer any two of the following

35. Write an essay on Bentham & Hookers system of classification
36. What are identification keys? Give the method of preparing such keys.
37. Describe the various techniques involved in herbarium preparation.

2 x10 = 20 marks

**Core Course - VII**

## COURSE – VII: GENERAL INFORMATICS, BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY & MOLECULAR BIOLOGY

### Model question- Subject wise distribution of marks

| Type of questions | Gen & Bio. informatics | Intro. Bio-technology | Mol.Biology | Total |
|---|---|---|---|---|
| 1 mark | 3 | 4 | 3 | 10x1=10 |
| 2 marks | 3 | 4 | 3 | 10x2=20 |
| 5 marks | 2 | 2 | 2 | 6x5 =30 |
| 10 marks | 1 | 1 | 1 | 2x10=20 |

Model Question not included

## Core Course - VIII

### Model question- Subject wise distribution of marks

| Type of questions | Plant Physiology | Biochemistry | Total |
|---|---|---|---|
| 1 mark | 5 | 5 | 10x1=10 |
| 2 marks | 5 | 5 | 10x2=20 |
| 5 marks | 3 | 3 | 6x5 =30 |
| 10 marks | 1 | 1 | 2x10=20 |

## SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

# CORE COURSE-VIII: PLANT PHYSIOLOGY AND BIOCHEMISTRY.

**Code: BOT6B08T**

**Time 3 Hours** **Total 80 marks**

## PART A

**Answer all the questions**

1. What are the assimilatory powers in photosynthesis.
2. The universal currency of free energy in biological systems is
3. Name aplant shows seismonastic movement
4. Fatty acid biosynthesis in germinating seeds takes place in ----------
5. Gve an example of a secondary metabolite
6. Which among the following is a secondary metabolite.
7. ---------- is a method of breaking dormancy
8. Name a sulphur containing amino acid.
9. Which is the hormone involved in stomatal closure.
10. Which is the pigment involved in the perception of photoperiodic signal.

10x1=10 marks

## PART B

**Answer all questions**

11. What is cohesion.
12. Define chlorosis.
13. Define tropic movements.
14. Define intermediary metabolism.
15. Mention the significance of glyoxylate cycle.

16. Give a brief description of secondary metabolites.
17. What is the difference between purines and pyrimidines.
18. Isoenzymes.
19. Transamination.
20. α oxidation

10x2=20marks

## PART - C

**Answer any six of the following**

21. Explain the mechanism of guard cell movement
22. Enumerate the physiological roles of auxin. Give the outline of auxin biosynthesis.
23 What are the components of water potential.
24. Explain the GS/GOGAT pathway.
25. Explain the classification of amino acids based on polarity.
26. Give an account of chemiosmotic hypothesis.
27. Outline the structure and functions of phospholipids
28. Explain the structure of phospholipids. Why these structures can conjugate with proteins to organize the membranes.

6x5=30 marks

## Part D

**Answer any two of the following**

29. Trace the path of electrons from water to $NADP^+$ during photosynthetic electron transport.
30. Give the IUB classification of enzymes. Explain the mechanism of enzyme action and add a note on the regulation of enzyme activity.
31. Describe the process of root nodule formation in leguminous plants and the biochemistry of $N_2$ fixation Explain the different levels of architecture of proteins.

2 x10=20 marks

## Core Course - IX

## Model question- Subject wise distribution of marks

| Type of questions | **Cell biology** | **Genetics** | **Plant breeding** | Total |
|---|---|---|---|---|
| 1 mark | 3 | 4 | 3 | 10x1=10 |
| 2 marks | 3 | 4 | 3 | 10x2=20 |
| 5 marks | 2 | 2 | 2 | 6x5 =30 |
| 10 marks | 1 | 1 | 1 | 2x10=20 |

**SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME**

**CORE COURSE -I X: CELL BIOLOGY, GENETICS &**

**PLANT BREEDING**

**Code: BOT6B010T**

[Total: 126 hours]

Time 3 Hours Total 80 marks

### Part- A

**Answer all the questions**

1. One gene - one enzyme hypothesis was proposed by ----------
2. The non-sticky end of a chromosome is called ----------
3. Nucleus was discovered by ----------
4. Mutation in a nucleotide is known as
5. Give an example of an intergeneric cross
6. CPCRI is involved in improvement of ----- crops
7. Dihybrid Testcross ratio is ----------
8. Initiation codon in protein synthesis is ----------
9. The giant nature of Salivary gland chromosome is due to ----------
10. Father of green revolution in India is ----------

10x1=10 marks

## Part - B

**Answer all questios**

11. What is vertical resistance?
12 Mention any 2 differences between mass selection and pure line selection.
13. What is plant introduction?
14. What are lethal genes? Give an example.
15. What are holandric genes?
16 Differentiate between transition and transversion.
17. Mention any two characteristic features of Fluid-Mosaic Model.
18. Write any two applications of radio isotopes in medicine.
19. Explain the complementary gene action.
20. Mention any two functions of nucleolus? 10x2=20 marks

## Part C

**Answer any six of the following**

21. Explain the structure and functions of an organelle associated with photosynthesis
22. Describe the morphology and ultra structure of chromosomes.
23. What is an operon? Explain the functioning of lac operon in Prokaryotes.
25. Differentiate between sex-limited and sex-influenced traits with suitable examples.
26. Explain the hybridization techniques adopted in Rice.
27. Give an account of polyploidy and their role in plant breeding.
28. Explain the ratio 12 : 3 : 1 6x5=30 marks

## Part - D

**Answer any two of the following**

**29.** With the help of labelled diagrams, explain the process of meoisis I.
**30.** Explain the molecular mechanism of DNA replication
31. Give an account of structural abberation and their meiotic consequences.

2x10=20 marks

## Core Course - X

## Model question- Subject wise distribution of marks

| Type of questions | Envt. Science | Phyto-Geography | Evolution | Total |
|---|---|---|---|---|
| 1 mark | 5 | 3 | 2 | 10x1=10 |
| 2 marks | 5 | 3 | 2 | 10x2=20 |
| 5 marks | 3 | 1 | 1 | 6x5 =30 |
| 10 marks | 2 | | 1 | 2x10=20 |

**SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME**

**CORE COURSE - X: ENVIRONMENTAL SCIENCE,**

**PHYTOGEOGRAPHY & EVOLUTION**

**Code: BOT6B010T**

**Time 3 Hours** **Max. 80 marks**

**Part- A**

**Answer all the questions**

1. The pioneer of xerosere is ----------
2. The unit of natural selection is ----------
3. ---------- is a non renewable resourse
4. When huge amount of sewage is dumped into a river BOD of the water will ----------
5. Species with restricted distribution are called----------
6. In allopatric speciation, the initial barriers for gene flow is ----------
7. Dissimilar organisms with closely related traits shows ---------- type of evolution
8. In which country industrial melanism was observed

9. Who proposed use and dis use theory?

10. Who is the author of Origin of species? 1x10=10 Marks

## PART B

**Answer all questions**

11. What is the application of cyropreservation

12. Why do some plants grow in saline oil.

13. What happens if ozone gets depleted?

14. Why do some species show restricted distribution?

15. What is endosymbiotic theory?

16. What are the major objections against Lamarckism?

17. What are e-waste?

18. What are paleoendemic?

19. What is adaptive radiation?

20. What is phylogeny? 10x2=20marks

## PART C

**Answer any six of the following**

21. What is species diversity? Compare α, β, and γ diversities.

22. Comment on the wise and judicious utilization of natural resources.

23. Discuss the role of various internatinal organization on environment protection.

24. Comment on the climates of India

25. Comment on the variability in a population.

26. Which an account on the evidences in support of evolution.

27. What is meant by discontinuous distribution? Explain the various theories?

28. Theory of Natural selection. 6x5=30marks

## Part D

**Answer any two of the following**

29. Define biodiversity. Explain the various means of conservation of biodiversity.

30. What is Plant succession? Explain the various stages involved in xerosere.

31. Discuss various theories on origin of life 2x10=20marks

**Model Questions of Open Courses and Elective Courses are not included. Question pattern will be the same as that of core and complementary papers.**

**Model Questions of Practical P-I, P-II and P-III will be included**

## B.Sc. PROGRAMME IN BOTANY- Complementary

### Course structure, Work load and Credit distribution

| Semester | Paper Code | Title of Paper | Hours/ Semester | Hours allotted / Week | Credit |
|---|---|---|---|---|---|
| S- I | BOT1C01 T | Complementary Course I. Angiosperm Anatomy & Micro technique | **36 hrs** | **2** | **3** |
| | BOT1C01 P | Complementary Course Practical -I | **36 hrs** | **2** | |
| S -II | BOT2C02 T | Complementary Course II. Cryptogams, Gymnosperms & Plant Pathology | **36 hrs** | **2** | **3** |
| | BOT2C02 P | Complementary Course Practical -II | **36 hrs** | **2** | |
| S-III | BOT3C03 T | Complementary Course - III. Morphology, Systematic Botany, Eco. Botany, Plant Breeding & Horticulture | **54 hrs** | **3** | **3** |
| | BOT3C03 | Complementary | **36 hrs** | **2** | |

| | | | | | |
|---|---|---|---|---|---|
| | P | Course practical -III | | | |
| **S-IV** | BOT4C04 T | Complementary Course - IV. Plant Physiology, Ecology & Genetics | **54 hrs** | **3** | **3** |
| | BOT4C04 P | Complementary Course practical -IV | **36 hrs** | **2** | |
| | | External Practical Examination | | | **4** |

## B.Sc. PROGRAMME IN BOTANY

### Complementary Course - Botany

### Course Structure, Mark Distribution, Scheme of Examination and Syllabus

| Course code & Title of course | Instructional Hours | | Dura-tion of Exams | Marks | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Practical | | |
| | Theor y | Pract. | | EE | IE | EE | IE | |
| **Semester –I BOT1C01 T** Anatomy & Micro technique | 36 | 36 | 3 hrs | 80 | 20 | -- | - | 100 |
| **Semester-II BOT2C02 T** Cryptogams, Gymnosperms & Plant Pathology | 36 | 36 | 3 hrs | 80 | 20 | - | -- | 100 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Semeser-III BOT3C03 T** Morphology, Syst. Botany, Eco. Botany, Plant Breeding & Horticulture | 54 | 36 | 3hrs | 80 | 20 | -- | -- | 100 |
| **Semester-III BOC04** Plant Physiology, Ecology & Genetics | 54 | 36 | 3hrs | 80 | 20 | - | -- | 100 |
| **Comp.course Practical** Ext..Ex.m -50 Record -20 Submission-10 | -- | -- | 3hrs | -- | - | 80 [50 + 20 + 10] | 20 | 100 |
| **Total** | 180 | 144 | | 320 | 80 | 80 | 20 | **500** |

## SCHEME OF EVALUATION

Evaluation of Theory paper and practical papers will be based on 80:20 pattern.

**Theory Examination**

Total - 100 marks

External - 80 marks

Internal - 20 marks

Distribution of internal marks [Theory]

Attendance - 5

Test paper - 10

Seminar & assignment 5

Total 20

**Practical Examination**

Total - 100 marks

External - 80 marks {Ext.Exam -50, Record-20, Submn-10}

Internal - 20 marks

Distribution of internal marks [Practical]

Attendance - 5

Record - 10

Lab involvement & test- 5

Total 20

**Submission**

Students are expected to submit 10 duly certified Herbarium sheets and field book on the day of Practical examination.

**First Semester Complementary Botany**

**Course Code: BOT1C01**

**ANGIOSPERMIC ANATOMY AND MICROTECHNIQUE**

Total: 72 Hours (Theory: 36 hours, Practical: 36 hours)

ANGIOSPERM ANATOMY

(Theory: 27 Hours)

**Module - I**

1. Tissues - Definition, Kinds - Meristematic & Permanent;

   a. Meristematic tissues - Classification – based on origin & position;

   Organisation of root apex and differentiation of tissue – Histogen theory;

   Organisation of stem apex and differentiation of tissues - Tunica & Corpus theory.

b. Permanent tissues - Definition - classification;

Simple tissues (Parenchyma, Collenchyma and Sclerenchyma),

Complex tissues ( Xylen & Pholem)

Secretory tissues - Glandular tissues (Nectaries in Euphorbia pulcherrima, Stinging hairs in Tragia)

Oil glands in Citrus, Eucalyptus;Digestive glands in Nepenthes;

Laticiferous tissues (Non-articulate latex ducts in Euphorbia and articulate latex duct – latex vessels in Hevea).

Hydathodes

2. Vascular bundles – types: conjoint - collateral, bicollateral, concentric and radial. 9 hrs.

**Module - II**

1. Primary structure of dicot and monocot root, dicot and monocot stem and leaf in dicot and monocot. 6 hrs.

**Module - III**

1. Normal secondary thickening in dicot stem (Polyalthea and Vernonia)

a. Intra stelar thickening: formation of cambial ring, its structure, fusiform and ray initials, storied and non - storied cambium, activity of the cambium, formation and structure of secondary wood, secondary phloem and vascular rays.

b. Extra stelar thickening: formation, structure and activity of the phellogen, formation of periderm in stem and root; bark and lenticel.

c. Growth rings, ring and diffuse porous wood, sapwood and heart wood, tyloses.

d. Normal secondary thickening in dicot root (Tinospora and Papaya)

2. Anomalous secondary growth in Boerhaavia. 12 hrs.

**Practicals - 30 Hours**

1. Identity simple and complex tissues and determine the type of vascular bundles using microscope.
2. Make suitable micro preparations to study the anatomy of the following:
   a. Dicot stem: Cucurbita, Centella (Primary structure);
      Polyalthea, Vernonia ( secondary structure).
   b. Monocot stem: Bamboo, grass
   c. Dicot root: Tinospora –young (Pri.), Tinospora – mature (Sec.)
   d. Monocot root: Colocasia, Musa
   e. Anomalous secondary growth (Boerhaavia).
   f. Dicot leaf: Ixora and Monocot leaf: paddy/grass

## MICROTECHNIQUE

(Theory: 9 hours)

**Module - I**

Microtechnique - Brief Introduction

1. Microscopy: simple, compound and electron microscope
2. Microtomy: Rotory type, serial sectioning, paraffin method, significance.
3. Killing and fixing: Killing and fixing agents and their composition (Farmer's fluid and FAA.)
4. Dehydration and clearing - reagents (mention only)

5. Stains – Saffranin and acetocarmine, preparation and use.

**Practicals - 6 hrs**

1. Familiarise the structure and working of compound microscope
2. Demonstration of microtome serial sectioning, staining and mounting.
3. Preparation of Safranin, FAA and Acetocarmine

**References: Anatomy**


1. Cuttler, EG. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
2. Cuttler, E.G. 1971. Plant Anatomy, Part III Organs Edward Arnold Ltd., London.
3. Esau K. 1985. Plant Antomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
4. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
5. Vasishta P.C. 1974. Plant Anatomy, Pradeep Publication, Jalandhar.
8. Tayal M.S Plant Anatomy. Rastogi Publishers, Meerut.


**References: Microtechnique**


1. Johansen, D.A. 1940. Plant Microtehnique. Mc Graw – Hill Book Company, Inc. New York.
2. Kanika, S. 2007. Manual of Microbiology – Tools and Techniques. Ane's student edition.
3. Khasim,S.K., 2002. Botanical Microtechnique; principles and Practice, Capital Publishing Company, New Delhi.
4. Toji, T. 2004. Essentials of botanical microtechnique. Apex Infotec Publ.

**Second Semester Complementary Botany**

**Course Code: BOT2C02T**

CRYPTOGAMS, GYMNOSPERMS & PLANT PATHOLOGY

Total: 72 Hours (Theory: 36 hours, Practical: 36 hours)

**Cryptogams, Gymnosperms & Plant Pathology**

Theory: 32hrs..

**Module - I**

1. Virus: General account of viruses, including structure of TMV & Bacteriophage. 2 hrs.
2. Bacteria: Classification based on shape of flagella, structure, nutrition (brief account), reproduction and economic importance - agriculture, industry and medicine. 3 hrs.
3. Cyanobacteria: General Account structure, life - history and economic importance of Nostoc 2 hrs.

**Module - II**

1. Phycology: General characters, classification, evolutionary trends in algae.
2. Structure, reproduction, life history and economic importance of the following classes with suitable examples:

   a) Chlorophyceae (Spirogyra)

   b) Phaeophyceae (Sargassum)

   c) Rhodophyceae (Polysiphonia). 7 hrs.

3. Mycology: General characters, classification (Alexopoulos, 1979). (brief mention only) and evolutionary trends in fungi.

Important features of the following divisions:

a) Mastigomycotina

b) Ascomycotina

c) Basidiomycotina.

4. Structure and life history of Puccinia (developmental details not required) 4 hrs.

**Module - III**

1. Bryology: General account, morphology and life - history of Riccia. 4 hrs.

2. Lichenology: General account and economic importance of Lichens with special reference to Usnea. 3 hrs.

3. Pteridology: General account, morphology and life history of Selaginella 4 hrs.

4. Gymnosperms: General account, morphology and life history of Cycas (Anatomy not required) 4 hrs.

**Module - IV**

1. Plant Pathology: Study the following plant diseases with special reference to pathogens, symptoms, method of spreading and control measures.

   1) Leaf mosaic of Tapioca 2) Citrus canker 3) Blast of paddy 3 hrs.

**Practicals: 32hrs.**

1. Make suitable micro preparations of vegetative and reproductive structures of Sargassum, Puccinia, Riccia and Selaginella
2. Identify and draw labelled diagrams of the types mentioned in the syllabus.

**Plant pathology**

Practical**:** 4 hrs.

1. Identify the diseases (mentioned in the theory syllabus) on the basis of symptoms and causal organisms.

**References: Cryptogams**


1. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
2. Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
3. Papenfuss, G.F. 1955. Classification of Algae.
4. B.R. Vasishta. Introduction to Algae
5. B.P. Pandey Algae
6. Mamatha Rao, 2009 – Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.
7. Sanders, W.B. 2001. Lichen interface between mycology and plant morphology. Bioscience, 51: 1025-1035.
8. B.R. Vasishta. Introduction to Fungi.
9. P.C. Vasishta Introduction to Bryophytes.
10. B.P. Pandey Introduction to Pteridophytes


**References: Gymnosperms**


1. Chamberlain C.J., 1935,Gymnosperms – Structure and Evolution, Chicago University Press.
2. Sreevastava H.N. 1980, A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
3. Vasishta P.C. 1980, Gymnosperms. S. Chand and Co., Ltd., New Delhi.


**References: Plant Pathology**


1. Agros, G.N. 1997. Plant Pathology ($4^{th}$ ed) Academic Press.

2. Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.

3. Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.

**Third Semester Complementary Botany**

**Course Code: BOT3C03T**

MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY,

PLANT BREEDING AND HORTICULTURE

Total: 90 Hours (Theory: 54 hours, Practical: 36 hours)

**Morphology**

Theory: 8 hrs.

**Module - I**

1. Leaf – Structure, simple, compound, venation and phyllotaxy.
2. Inflorescence - racemse, cymose , special, types with examples
3. Flower - as a modified shoot- structure of flower - floral parts, their arrangement, relative position, cohesion and adhesion of stamens, symmetry of flowers, types of aestivation and placentation, floral diagram and floral formula. 8 hrs.

**Practicals: 4 hrs.**

1. Identity the different types of inflorescence included in the syllabus and record the same 4 hrs.

**Reference:- Morphology**

1. Sporne, K.R. 1974. Morphology of Angiosperms. New Delhi.

**Systematic Botany**

Theory; 28 hrs**.**

**Module- I**

1. Introduction, scope and importance 1hr.
2. Herbarium techniques: collection, drying, poisoning, mounting & labelling. Significance of herbaria and botanical gardens; Important herbaria and botanical gardens in India. 4 hrs.
3. Nomenclature - Binomial system of nomenclature, basic rules of nomenclature (validity, effectivity and priority), International Code of Botanical Nomenclature. 3 hrs.
4. Systems of classification - Artificial, Natural of Phylogenetic (Brief account only). Bentham & Hooker's system of classification in detail. 4 hrs.
5. Modern trends in taxonomy - Chemotaxonomy, Numerical taxonomy and Cytotaxonomy (brief account only) 2 hrs.
6. Study the following families: Malvaceae, Fabaceae (with sub-families) Rubiaceae, Apocynaceae, Euphorbiaceae and Poaceae. 14 hrs.

**Systematic Botany**

**Practical: 20hrs.**

1. Determine the systematic position of local plants comes under the syllabus based on their vegetative and floral characters
2. Students shall be able to describe the plants in technical terms and draw the L.S. of flower, floral diagrams and the floral formula of two plants

belong to each family and record the same.

3. Students are expected to submit ten properly identified duly certified herbarium specimens belonging to families included in the syllabus during the practical examination.

**References: Systematic Botany**


1. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harpor & Row Publishers, New York.
2. Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
3. Jeffrey,C. 1968. An introduction to Plant Taxonomy, London
4. Gurucharan Singh, 2001. Plant Systematics. Theory and practice. Oxford & IBH Publications New Delhi.
5. Sharma O.P. 1990, Plant Taxonomy – Tata McGraw Hills. Publishing company Ltd
6. Subramanyam N.S. Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
7. Pandey & Misra. Taxonomy of angiosperms. Ane books Pvt Ltd.


**Economy Botany**

Theory: 4 hrs.

**Module -I**

1. Brief account on the various categories of plants based on their economic importance
2. Study the following plants with special reference to their binomial, family, morphology of the useful part and their uses.
    1. Cereals - Paddy, Wheat
    2. Pulses - Black gram, Green gram
    3. Oil - Coconut, Gingelly

4. Fibre - Cotton
5. Latex - Rubber
6. Beverages - Tea, Coffee
7. Spices - Pepper, Cardamom, Clove
8. Medicinal plants – *Rauvolfia serpentina*, *Justicia adhatoda*, *Santalum album* and *Curcuma longifolia*.

**Practical: 4 hrs.**

1. Identify at sight the economically important plant produces and products mentioned in module III, and learn the binomial and family of the source plants, morphology of the useful parts and uses.

**References: Economic Botany**


1. Pandey B. P (1987) - Economic Botany
2. Verma V. (1984) - Economic Botany
3. Hill A.W (1981) - Economic Botany, McGraw Hill Pub


**Plant Breeding**

Theory: 7hrs.

1. Objectives of plant breeding
2. Methods of plant breeding: a) Plant introduction b) Selection - Mass, Pure line and clonal, c) Hybridization : intervarietal, interspecific and intergeneric hybridization. d) Mutation breeding e) polyploidy breeding and f) reeding for disease resistance

**Practical: 4 hrs.**

1. Demonstration of hybridization technique

**References: Plant Breeding**


1. Allard. R.W. 1960. Principles of Plant breeding, John Wiley & Sons, Inc,

New York.

2. Singh, B.D. 2005. Plant Breeding - Principles & methods , Kalyani Publishers, New Delhi.
3. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.

**Horticulture**

Theory: 7 hrs.

1. Horticulture- introduction: definition, branches, significance
2. Methods of plant propagation:

a. Seed propagation

b. Vegetative propagation

1. Cutting – stem, root, leaf
2. Layering –air layering
3. Grafting: Approach grafting, Tongue grafting
4. Budding: Patch and T-budding

**Practical: 4 hrs.**

1. Demonstration of layering, grafting and budding

References:- Horticulture

1. Text book of Horticulture - K. Manibhushan Rao - Macmillan India Ltd.
2. Introduction to Horticulture – N. Kumar (First Edition, Rajalakshmi Publication,1996)

## Fourth Semester Complementary Botany

## PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

**Course Code: BOT4C04T**

Total: 90 Hours (Theory: 54 hours, Practical: 36 hours)

PLANT PHYSIOLOGY

[Theory: 36 hours]

**Module - I**

1. Structure of plant cell and cell organelles (Brief account only)
2. Water relations - Permeability, Imbibition, Diffusion, Osmosis and water potential
3. Absorption of water- Active and passive mechanisms
4. Ascent of sap -Root pressure theory, Transpiration pull or cohesion-tension theory.
5. Transpiration -Types, mechanism of stomatal movement: $K^+$ ion theory, significance of transpiration, antitranspirants.

12 hrs.

**Module - II**

1. Photosynthesis-Introduction, significance, Two pigment systems, red drop,

   Emerson enhancement effect, action and absorption spectra.

   Mechanism of photosynthesis - Light reaction, cyclic & non-cyclic photo phosphorylatin,

   Dark reactions–Calvin cycle, $C_4$ cycle, photorespiration (a brief account only).

   Factors affecting photosynthesis.

2. Respiration-Definition, Kinds of respiration-aerobic and anaerobic;

   Glycolysis, Krebs cycle, Terminal oxidation, Fermentation

15 hrs.

**Module - III**

1. Plant growth-Definition, phases of growth, natural plant hormones, synthetic auxins (Brief account only)
2. Senescence and abscission, Photo-periodism & vernalization.
3. Dormancy of seeds- Factors causing dormancy, photoblastin, techniques to break dormancy, physiology of fruit ripening.

9 hrs.

**Practicals - 18 hours**

Learn the principle and working of the following apparatus/experiments

1. Thistle funnel osmoscope
2. Ganong's potometer
3. Ganong's light-screen
4. Ganong's respirometer
5. Absorbo transpirometer .
6. Kuhne's fermentation vessel
7. Mohl's half-leaf experiment
8. Experiment to demonstrate suction due to transpiration
9. Experiment to show evolution of $O_2$ during photosynthesis

**References:**


1. William G. l-lopkins,(1999). Introduction to Plant Physiology, 2nd editio Wiley A Sons, Inc.
2. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd editi publishers and distributers.
3. G. Ray Noggle and George J.Fritz Introductory Plant Physiology Prentice Ha
4. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemis edition. CBS Publishers and distributors.

## PLANT ECOLOGY

[Theory: 9 hours]

**Module - I**

1. Ecology-Definition, Ecosystem: ecological factors –biotic and abiotic.

2 hrs.

2. Ecological adaptations: Morphological, anatomical and physiological adaptations of the following types: Hydrophyte (Vallisnaria, Hydrilla), Xerophyte (Opuntia, Nerium), Halophyte (Avicennia), Epiphytes (Vanda )and parasites (Cuscuta). 4. hrs.

3. Ecological succession –Process of succession, types of succession, Hydrosere

3. hrs.

**Practicals**

Total: 9 hrs.

Study the morphological and anatomical adaptations of the hydrophytes, xerophytes, halophytes, epiphytes and parasites mentioned in the syllabus

**References:**


1. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co.Varanasi.
2. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. Michael S. 1996. Ecology. Oxford University Press, London.
4. Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.
5. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.

## GENETICS

**Theory: 9hrs**.

1. Introduction and brief history of genetics

2. Mendel's experiments, symbolisation, terminology, heredity and variation; 3. Monohybrid cross, Dihybrid cross, Laws of Mendel, test cross and back cross.

4..Modified Mendelian ratios 1) Incomplete dominance in Mirabilis jalapa

5.Gene interactions: Complementary genes -flower colour in *Lathyrus odoratus* (9:7ratio), Epistasis - Fruit colour in *Cucurbita pepo* (12:3:1 ratio).

**Practical: 9 hrs.**

1. Students are expected to work out problems related to Monohybrid, Dihybrid, Test cross, Incomplete dominance and Modified Mendelian ratios and has to be recorded.

References: - Genetics


1. Sinnot, W.L.C. Dunn & J. Dobzhansky 1996. Principles of Genetics. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
2. Verma, P.S. & Agarwal 1999. Text book of Genetics. S. Chand & Co., New Delhi.
3 RastogiV.B. 2008, Fundamentals of Molecular Biology, Ane Books, India.
4 Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut.

First Semester Complementary Botany

ANATOMY & MICROTECHNIQUE

Course Code: BOT1C01T

Time: 3hrs

Max. 80 marks

Part A

(Answer all questions)

1. Quiescent centre is found in ----------
2. Casparian strips occur in ----------
3. Proponent of Kopper-Kappe theory
4. Calcium carbonate crystals are found as ----------
5. Name a dicot plant showing anomalous secondary growth
6. Type of stomata in Ixora is ----------
7. Name a fixative agent
8. Roughness of grass leaf is due to the presence of
9. Give the expansion of FAA
10. Growth of cells wall is accomplished by ----------

10x1=10 marks

Part B

(Answer all questions)

11. What are tyloses? Mention their function
12. What are annual rings?
13. Laticiferous tissue
14. Concentric vascular bundles
15. Monocot vascular bundle
16. What are lenticels?
17. Define resolving power
18. Name the optical parts of a compound microscope
19. Acidic stains
20. Natural dyes

10x2= 20 marks

Part C

(Answer any six of the following)

21. What is meristem? Classify them based on position, origin and function.
22. With suitable labelled diagrams, describe the primary structure of a dicot stem.
23. Explain the extra stelar secondary growth in stem
24. Give a detailed account of isobilateral leaf with the help of labelled sketch
25. Brifly describe the mechanism of electron microscope
26. Important anatomical characters of Dicot root
27. Comment on Sap wood and heart wood
28. Distinguish between ring porous wood and diffuse porous wood

6x5=30marks

Part D

(Answer any two of the following)

35. With suitable labelled diagrams, describe the simple and complex tissues in plants
36. Describe the anomalous secondary growth in Boerhaavia stem
37. Describe the normal secondary growth in dicot root with suitable diagrams.

2 x10=20 marks

Second Semester Complementary Botany

CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Course Code: BOT2C02T

Time: 3hrs

Max. 80 marks

**Part A**

(Answer all questions)

I. Fill in the blanks with suitable words.

l. Nucleus of Nostoc is ---------
2. ---------- is an example for Gm-ive bacteria
3. ---------- is the pathogen responsible for Blast of paddy
4. Cell wall of Bacteria is made up of ----------
5. ---------- are non vascular embryophytes
6. Viroids are --------
7. Fruting body of Usnea is ----------
8. Whittker placed Bacteria in the Kingdom ----------
9. ---------- discovered Virus

10. Heterospory is seen in ----------
1x10=10 marks

**Part B**

(Answer all questions)

II. Answer all questions
11. Describe rhizoids in Riccia
12. What is heterospory?
13. What are heterocyst?
14. Give the expansion of AIDS & HIV
15. Account on shoots in Pinus
16. What do you mean by heteroceous fungi?
17. Pigments in Algae
18. Biological control
19. Cystocarp in Polysiphonia
20. Symptoms of the Blast of paddy l0 x 2 = 20 marks

**Part - C**

**III. (**Answer any six (short essay)

21. Explain the morphology of rhizophore in Selaginella
22. List out different methods of disease control
23. Describe the structure of Riccia sporophyte.
24. Draw a neat labeled diagram of Bacteria
25. Distinguish between Cryptostomata and Conceptacle
26. Describe the receptacle of Sargassum
27. Describe the structure of a Bacteriophage
28. Give an account on the reproduction in Lichens 6 x 5=30 marks

**Part-C**

(Answer any two (long essay)

29. Describe the life cycle of a heterecious fungus
30. Describe the methods of reproduction in Bacteria.
31. Describe various types of sexual reproduction in Spirogyra.

2x10=20 marks

Third Semester Complementary Botany

MORPHOLOGY, SYSTEMATIC, BOTANY, ECONOMIC BOTANY,

PLANT BREEDING AND HORTICULTURE

Course Code: BOT3C03T

Time: 3hrs Max. 80 marks

**Part A**

(Answer all questions)

I. Answer in one word

1. Spadix is an inflorescence found in ----------
2. Leaves without petiole are called ----------
3. Most of the cereals belong to the family …….
4. Name the author of "Species plantatrum"
8. Name the family with inferior ovary
9. Coffee and tea belong the category ----------
10. Give an example of Phylogenetic system of classification

1x10=10 marks

**Part B**

(Answer all questions)

11. Define phyllotaxy. Mention different types.
12. Chemicals used to protect herbarium sheets.
13. Why grafting is not successful in monocots?
14. Name the alkaloids extracted from Raucifolia.
15. Draw the floral diagram of Fabideae
16. Principles of ICBN
17. Describe the spikelet in Poaceae
18. Comment on the morphology of angiosperm flower
19. Give the binomial, Family and useful part of cotton and rubber
20. Define T-budding

2x10=20 marks

**Part C**

(Answer any six of the following)

21. Mass selection and Pureline selection
22. Organization of ICAR
23. What is the importance of Quarantine in plant breeding technique?
24. What is meant by Doctrine of signature? Explain it by giving suitable examples.
25. Describe the characters of the family Rubiaceae
26. What is placentation? Write different types.
27. Describe Resistance breeding
28. Describe different methods of vegetative propagation

6x5=30 marks

**Part D**

(Answer any two of the following)

29. Write an essay on Bentham & Hookers's system of classification
30. Discuss the modern trends in taxonomy giving suitable examples.
31. Define hybridization and describe the process of hybridization.

2x10=20marks

Fourth Semester Complementary Botany

PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

Course Code: BOT4C04T

Time: 3hrs Max. 80 marks

**Part A**

(Answer all questions)

I. Answer in one word

1. Name the Father of Genetics
2. ---------- is a Xerophyte
3. Name the enzyme which fixes $CO_2$ in $C_3$ plants
4. Wilting of plants occurs when ---------- tissue is removed
6. The cohesion tension theory regarding ascent of sap was given by ----------
-
7. Incomplete dominance is reported in ----------
8. The oxidation of $NADH_2$ yields ---------- number of ATP
9. Give an example of inter genic interaction
10. Ethylene gas is used for ----------

1X10=10 marks

**Part B**

(Answer all questions)

Short answer questions

11. Define fermentation.
12. What is photolysis?
13. Mention the role of pneumatophore
14. Methods to overcome dormancy
15. Briefly explain photophosphorylation
16. Photosystems in plants
17. Define water potential
18. Define Abscission &scenescence
19. Test cross & Back cross
20. Vernalization

2X10=20 marks

**Part C**

(Answer any six of the following)

21. Describe glycolysis and its significance

22. What is oxidative phosphorylation? Explain its significance
23. Explain the role of auxins and cytokinins in plant growth and development.
24. What is photoperiodism? Classify plants accordingly.
25. How is cactus adapted to live in deserts?
26. Describe epistsis with example.
27. List out the adaptations in Hydrophytes
29. Describe the stomatal mechanism in plants

5X6=30 marks

**Part D**

Answer any two of the following

35. Discuss the mechanism and significance of Hatch and Slack pathway in Photosynthesis.
36. Describe the steps of citric acid cycle.
37. What is plant succession? Describe Hydrosere.

2X10= 20 marks

## Complementary Course- Botany

## Model Practical Examination

**Time: 3 hrs** **Max. 50marks**

1. Prepare a T.S. of specimen **A**. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation.

   (Preparation – 4; Diagram – 3; Reasons 2; Identification – 1) 10 marks

2. Refer specimen **B** to its family, giving diagnostic characters. (Identification 1 + Reasons 4) 5 marks

3. Take a V.S.. of flower **C**. Draw a labelled diagram. Construct the floral diagram and give the floral formula.

   (Diagram - 2, Floral diagram - 2, Floral formula - 1) 5 marks

4. Make suitable micropreparations of D. Draw labelled diagram. Identify giving reasons. Leave the preparation for valuation.

   (Preparation – 2, Diagram – 1, Identification – 1, Reasons – 1)5 marks

5. Determine the ecological group of specimen E, with important adaptations.

   (Identification - 1 + Adaptations -2 ) 3 marks

6. Set up the experiment F. Explain the working and state its aim:

(Set up – 2; Working – 2; Aim – 1) 5 marks

7. Give the binomial, family and morphology of useful parts in G & H.

(Bonomial – 1; Family - 1 ; Morphology - 1) 2x3 = 6 marks

8. Name the disease, pathogen and important symptoms in I.

(Name -1, Pathogen -1, Symptoms - 2) 4 marks

9. Spot at sight, specimens J,K,L, M & N 1X5=5 marks

10. Genetics problem –O. 4 marks

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50 marks

| | |
|---|---|
| Record | 20 marks |
| Submission (Herbarium sheets) | 10 marks |
| Total | 80 marks |

## Scheme of Specimens

1. A - Anatomy materials – root or stem (Primary or Secondary) and anomalous secondary thickening (*Boerhaavia* stem)
2. B - Twig with flower of dicot plants mentioned in the syllabus
3. C - A flower and flower buds belong to the families included in the

- Specimens from cryptogams included in the syllabus

4. D - Puccinia
5. E - Ecology materials given in their respective centres.
6. F - Physiological experiments mentioned in the syllabus
7. G &H - Economic botany materials included in the syllabus
8. I - Diseased specimens included in the syllabus
9. J, K, L, Specimens or slides from the Thallophyta, Bryophyta, Pteridophyta and Gymnosperms

   M - Microtechnique

   N - Herbarium sheet from students' submission.

12. O - Genetics problem.