File Ref.No.6218/GA - IV - J1/2012/CU

UNIVERSITY OF CALICUT

Abstract

BSc in Botany-CUCBCSS UG 2014-Scheme and Syllabus- Approved-Implemented-w.e.f 2014 Admissions-Orders issued.

G & A - IV - J

U.O.No. 6926/2014/Admn Dated, Calicut University.P.O, 17.07.2014

Read:-1. U.O. No. 3797/2013/CU, dated 07.09.2013 (CBCSS UG Modified Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

2. U.O. No. 5180/2014/Admn, dated 29.05.2014 (CBCSS UG Revised Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

3. Item no. 1 of the minutes of the meeting of the Board of Studies in Botany UG held on 03.04.2014.

4.Item no. 6 of the minutes of the meeting of the Faculty of Science held on 27.06.2014.

5.Orders of the VC on 14.07.2014, in the file no, 18602/GA IV /J1/2013/CU.

ORDER

The Modified Regulations of Choice Based Credit Semester System for UG Curriculum w.e.f 2014was implemented under the University of Calicut vide paper read as (1). The Revised CUCBCSS UG Regulations has been implemented w.e.f 2014 admission, for all UG programme under CUCBCSS in the University, vide paper read as (2).

The Board of Studies in Botany UG finalized the revised syllabus of BSc Botany for implementation w.e.f the Academic Year 2014-2015. vide paper read as (3). The Faculty of Science has also approved the minutes of the Board vide paper read as (4).

The Hon'ble Vice Chancellor, considering the exigency, exercising the powers of the Academic Council has approved the items regarding syllbus implementation in the minutes of the concerned Boards of Studies mentioned in the minutes of the Faculty of Science, subject to ratification by the Academic Council, vide paper read as (5).

Sanction has, therefore, been accorded for implementing the Scheme and Syllabus of BSc. in Botany under CUCBCSS UG 2014, in the University, w.e.f 2014 Admissions.

Orders are issued accordingly.

(The syllabus is available in the website: universityofcalicut.info)

Muhammed S

Deputy Registrar

To

1. All Affiliated Colleges/SDE/Dept.s/Institutions under University of Calicut.
2. The Controller of Examinations, University of Calicut.
3. The Director SDE, University of Calicut.

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

SYLLABUS

for

UNDER GRADUATE PROGRAMME

in

BOTANY

Effective from
2014 admission

Members of Board of Studies –Botany (UG)

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9. Sri. Ranji P. Mathew,
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10. Dr. Egy T. Paul,
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11. Sri. G. Jayakrishnan,
    Associate professor,
    Sree Krishna College, Guruvayur. Chairman (P.G.)

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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 revised 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 Botany
2. To inculcate interest in nature with its myriad living forms
3. To develop scientific temper 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 periods 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; 24 credits from two complementary courses, 2 from open course and 56 from Core courses (including 2 credits for project work).

Table-1 Credit Distribution of B.Sc. Botany Programme

Semester	Common course		Core course	Complementary course		Open	Total
	English	Additional Language		Chem	Zool		
I	4+3	4	3	2	2		18
II	4+3	4	3	2	2		18
III	4	4	3	2	2		15
IV	4	4	3+4*	2+4*	2+4*		27
V			4+4+4 +3			2	17
VI			3+3+3 3+3 +4*+4* +2**				25
Total	**22**	**16**	**56**	**12**	**12**	**2**	**120**

*Credits of Practical Exam

** Credits of Project Work

Table-2: Course wise Mark Distribution of B. Sc Botany Programme

English Courses	Theory	6 x 100	600	600
Add. Lan. Courses	Theory	4 x 100	400	400
Core Courses	Theory	13 x 100	1300	1750
	Practical	3x 100	300	
	Record	3x 20	60	
	submission	4 x10	40	
	Project	1 x 50	50	
Open Courses	Theory	1 x 50	50	50
Compl. Courses	Theory	8 x 80	640	800
	Practical	2 x 80	160	
TOTAL				**3600**

Table-3: SEMESTERWISE DISTRIBUTION OF CREDITS AND MARKS

B.Sc. Botany Programme

Total Credits: 120; Total Marks: 3600

Semester	*Course*	*Credit*	*Marks*
I	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course I: Angiosperm Anatomy	3	100
	Complementary course: Chemistry	2	80
	Complementary course: Zoology	2	80
	Total	**18**	**560**
II	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course II: Research methodology & Microtchnique	3	100
	Complementary course: Chemistry	2	80
	Complementary course: Zoology	2	80
	Total	**18**	**560**
III	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course III: Microbiology, Mycology, Lichenology & Plant Pathology	3	100
	Complementary course: Chemistry	2	80
	Complementary course: Zoology	2	80
	Total	**15**	**460**
IV	Common course: English	4	100

	Common course: Additional Language	4	100
	Core Course IV: Phycology, Bryology & Pterido.	3	100
	Core Course Practical- Paper- I	4	100
	Record + Submission [20+10]		30
	Complementary course: Chemistry	2	80
	Complementary course: Chemistry Practical	4	80
	Complementary course: Zoology	2	80
	Complementary course: Zoology Practical	4	80
	Total	**27**	**750**
V	Core Course V: Gymno., Palleob., Phytog. & Evoln.	3	100
	Core Course VI: Angio. Morph. & Systematics	4	100
	Core CourseVII: Emb.,Palyn.,Eco.Bot.,Ethno.&Hort.	4	100
	Core Course VIII:Gen.&Bioinfor. Biotech.& Mol.Bio.	4	100
	Open course	2	50
	Total	**17**	**450**
VI	Core Course IX: Genetics & Plant Breeding	3	100
	Core Course X: Plant Physiology & Metabolism	3	100
	Core Course XI: Cell Biology & Biochemistry	3	100
	Core Course XII: Environmetal Science	3	100
	Core Course XIII: Elective	3	100
	Core Practical – Paper- II	4	100
	Record + Submission [20+10]		30
	Core Practical – Paper- III	4	100

	Record + Submission [20+10]		30
	Record of Elective paper		10
	Core Course: Project Work	2	50
	Total	**25**	**820**

Project work

Every student has to undertake a project work of 2 credits during the tenure of Vth and VIth semester. Project work at UG level shall be of group nature. A group of not more than five students can undertake one project under the supervision of a faculty member as per the curriculum. However, the evaluation of the project work shall be conducted at the end of the sixth semester, along with the practical examination. **The total marks ear marked for the project work is 50 (Internal-10 & External-40).** The marks shall be awarded on the basis of the originality, structural and content wise perfection of the work.

Guidelines for the Evaluation of projects

The evaluation of the project will be done at two stages:

a) Internal Assessment (supervising teachers will assess the project work and award internal marks) Internal assessment should be completed 2 weeks before the last working day of VIth Semester. Internal assessment marks should be published in the department.

b) External evaluation of the project shall be done by the external examiner appointed by the University along with practical examinations.

c) Marks secured for the project will be awarded to the candidate after totaling the internal and external marks

d) While totaling, the internal and external marks is to be taken in the ratio1:4.

Table-4. Criteria for awarding internal and external marks for Project work

Criteria for internal evaluation of the Project work		**Criteria for external evaluation of the Project work**	
Internal (20% of total)		External (80% of total)	
Involvement	20	Relevance of the topic. Statement of Objectives, Methodology	20
Utilization of data	20	Quality of analysis Use of statistical tools, Findings and recommendations	10
Organization of report	30	Presentation	20
Viva	30	Viva	50

EXAMINATIONS

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. Project evaluation, viva-voce if any, shall be

conducted along with the practical examination towards end of sixth semester.

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 earmarked for internal evaluation. 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-5: Parameters with percentage of marks for Internal Evaluation of Theory and Practical Examination

Parameters		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 4	Assignment & Seminar	25%		3 2	
5	Timely submission		50%	nil	10
6	Submission		25%	nil	5
7	Total	100%	100%	20	20

Table-6 Percentage of Attendance and eligible marks

% of attendance	% of marks to 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.

INDIRECT GRADING SYSTEM

An 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.

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 theory 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 shall 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 topics in the syllabus.
8. Model question papers are given in annexure-1

Table-7 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 rather than their theoretical knowledge. There must be confidentiality in the problems to be asked in the examination. The external evaluation of practical examination shall be conducted by two examiners appointed by the university. Because of the special nature of the practical examination, the board unanimously proposed that both examiners should be external in order to maintain the secrecy and seriousness of the examination.

Practical Record

The entire experiments mentioned in the practical syllabus are expected to be done and recorded. 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 set apart for the record of the programme are 60 i.e., 20 marks for the record of each practical paper.** 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 practical works mentioned under individual courses
b. Neatness and scientific accuracy
c. Timely submission

Submissions

Submissions are mandatory for each practical paper and it carries 50 marks altogether. The items to be submitted as part of each practical paper for valuation are appended below.

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 duly certified by the Head of the department.

Practical Paper – II

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.

Practical Paper –III

Every student has to submit a duly certified detailed report on the visit to either an established Biotechnology laboratory or the Plant breeding station nearby.

There is no practical examination for elective papers; the practical works mentioned in the syllabus has to be done, recorded, and certified and to be submitted on the day of dissertation evaluation as part of submission.

Table-8: Mark distribution of submissions

Submission	Items	Marks
Pract. P-I	a. Specimens from algae, fungi, lichen and pathology b. Articles/photographs/ specimens of Horticultural significance	5 5
Pract. P-II	a. Herbarium & Field book c. Tour report	8 2
Pract. P-III	a. Report of Biotechnology / Plant breeding station visit	10
Dissertation evaluation day	Record of Elective Paper	10
Total		40

Table-9: Course structure, Work load and Credit distribution

B.Sc. PROGRAMME IN BOTANY- Core

Semester	Paper Code	Title of Paper	Instructional hours/ Semester	Hours allotted / Week	Credit
S- I	BOT1B01T	CORE COURSE I. ANGIOSPERM ANATOMY	36 hrs	2	3
	BOT1B01P	CORE COURSE. PRACTICAL -I	36 hrs	2	
S -II	BOT2B02T	CORE COURSE II. RESEARCH METHODOLOGY & MICROTECHNIQUE	36 hrs	2	3
	BOT2B02P	CORE COURSE. PRACTICAL -II	36 hrs	2	
S-III	BOT3B03T	CORE COURSE III. MICROBIOLOGY, MYCOLOGY, LICHENOLOGY & PLANT PATHOLOGY	54 hrs	3	3
	BOT3B03P	CORE COURSE. PRACTICAL -III	36 hrs	2	
S-IV	BOT4B04T	CORE COURSE IV PHYCOLOGY, BRYOLOGY & PTERIDOLOGY	54 hrs	3	3
	BOT4B04P	CORE COURSE. PRACTICAL -IV	36 hrs	2	
		PRACTICAL PAPER - I ANGIOSPERM ANATOMY, RESEARCH METHODOLOGY, MICROTECHNIQUE, MICROBIOLOGY, MYCOLOGY, LICHENOLOGY, PLANT PATHOLOGY, PHYCOLOGY, BRYOLOGY & PTERIDOLOGY			4
S-V	BOT5B05T	CORE COURSE V GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY & EVOLUTION	63 hrs	3.5	3
	BOT5B05P	CORE COURSE. PRACTICAL -V	36 hrs	2	
	BOT5B06T	CORE COURSE VI ANGIOSPERM MORPHOLOGY & PLANT SYSTEMATICS	63 hrs	3.5	4
	BOT5B06P	CORE COURSE. PRACTICAL -VI	36 hrs	2	

Semester	Paper Code	Title of Paper	Instructional hours/ Semester	Hours allotted / Week	Credit
S-V	BOT5B07T	CORE COURSE VII EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHANOBOTANY & HORTICULTURE	63 hrs	3.5	4
	BOT5B07P	CORE COURSE. PRACTICAL VII	36 hrs	2	
	BOT5B08T	CORE COURSE. - VIII GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY, MOLECULAR BIOLOGY	63 hrs	3.5	4
	BOT5B08P	CORE COURSE. PRACTICAL -VIII	36 hrs	2	
	BOT5D01	OPEN COURSE - CHOICE I GENERAL BOTANY	54 hrs	3	2
	BOT5BD02	OPEN COURSE - CHOICE II APPLIED BOTANY	54hrs	3	2
	BOT5D03	OPEN COURSE - CHOICE III TISSUE CULTURE	54 hrs	3	2
S – VI	BOT6B09T	CORE COURSE IX GENETICS & PLANT BREEDING	54hrs	3	3
	BOT6B09P	CORE COURSE. PRACTICAL IX	36 hrs	2	
	BOT6B10T	CORE COURSE - X PLANT PHYSIOLOGY & METABOLISM	54hrs	3	3
	BOT6B10P	CORE COURSE. PRACTICAL - X	36 hrs	2	
	BOT6B11T	CORE COURSE -XI CELL BIOLOGY & BIOCHEMISTRY	54hrs	3	3
	BOT6B11P	CORE COURSE. PRACTICAL - XI	36 hrs	2	
	BOT6B12T	CORE COURSE – XII ENVIRONMENTAL SCIENCE	54 hrs	3	3
	BOT6B12P	CORE COURSE PRACTICAL – XII	36 hrs	2	
		ELECTIVE- CHOICE - I	72 hrs	4	3

Semester	Paper Code	Title of Paper	Instructional hours/ Semester	Hours allotted / Week	Credit
S - VI	BOT6B13T	GENETIC ENGINEERING			
	BOT6B13P	ELECTIVE – I PRACTICAL	18 hrs	1	
	BOT6B014T	ELECTIVE- CHOICE II GENETICS AND CROP IMPROVEMENT	72 hrs	4	3
	BOT6B014P	ELECTIVE. PRACTICAL	18 hrs	1	
	BOT6B015T	ELECTIVE - CHOICE III ADVANCED PLANT SYSTEMATICS	72 hrs	4	3
	BOT6B015P	ELECTIVE -. PRACTICAL	18 hrs	1	
		PROJECT WORK			2
		PRACTICAL PAPER- II GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY, EVOLUTION ANGIOSPERM MORPHOLOGY, PLANT SYSTEMATICS, EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHANOBOTANY, HORTICULTURE, GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY & MOLECULAR BIOLOGY			4
		PRACTICAL PAPER- III GENETICS, PLANT BREEDING PLANT PHYSIOLOGY, METABOLISM CELL BIOLOGY, BIOCHEMISTRY & ENVIRONMENTAL SCIENCE			4

Table-10: Course structure and mark distribution

B.Sc. PROGRAMME IN BOTANY
Core Course - Botany
Course Structure, instructional hours, Mark Distribution and 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
BOT4B04T	54	36	3hrs	80	20	--	--	100
Core Pract. P-I Record Submission			3 hrs			80 20 10	20	100 20 10
BOT5B05 T	63	36	3 hrs	80	20	--	--	100
BOT5B06 T	63	36	3 hrs	80	20	--	--	100
BOT5B07T	63	36	3hrs	80	20	--	--	100
BOT5B08T	63	36	3hrs	80	20	--	--	100
BOT6D01/02/03 T	54	---	3 hrs	40	10	--	--	50
BOT6B09 T	54	36	3 hrs	80	20	--	--	100
BOT6B10 T	54	36	3hrs	80	20	--	--	100
BOT6B11T	54	36	3hrs	80	20	--	--	100
BOT6B12T	54	36	3hrs	80	20	--	--	100
BOT6B13T	90		3hrs	80	20	--	--	100

Core Pract. P-II Record Submission			3 hrs			80 20 10	20	100 20 10
Core Pract. P-III Record Submission			3hrs			80 20 10	20	100 20 10
Record of Elective Paper						10		10
Project work						40	10	50
Total				**1080**	**270**	**380**	**70**	**1800**

EE* *– External Evaluation marks ; IE* - Internal Evaluation marks

FIRST SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE 1- ANGIOSPERM ANATOMY

Code: BOT1B01T

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

ANGIOSPERM 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; 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 oxalate, Drusses, Raphides, 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- (protodern, 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 & Phloen 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) 6 hrs.

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 & (*Polyalthia*, *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.

5. Anomalous secondary growth - general account with special reference to the anomaly in Dicot stem – *Boerhaavia*, *Bignonia* and Monocot stem- *Draceana* 3 hrs.

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 *Draceana*

References

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. Eames, A. J. & L H Mac Daniels 1987 An Introduction to Plant Anatomy. Tata Mac Grew Hill Publishing company Ltd. New Delhi.
4. Esau K. 1985. Plant Antomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
5. Fahn A 2000. Plant Anatomy. Permagon Press.
6. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
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: RESEARCH METHODOLOGY AND MICROTECHNIQUE

Code: BOT2B02T

[Total 72 hours; Theory 36, Practical 36]

RESEARCH METHODOLOGY

Theory: 23 hrs. (1 ¼ hours 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 2 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.
6. Documentation of experiments, record keeping.
7. Research report writing; familiarizing biological journals
8. Latest methods of presentation.

6 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
7. Design of experiments: Latin square, randomized Block design, factorial.

8 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. Centrifugation: Principle, types of centrifuges and their applications
5. Chromatography - Principle and types: Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Molecular sieving.

7 hrs.

PRACTICALS **[**Total: 22 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, and probability.
6. Familiarize 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: 13 hrs. (3/4 hr. 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 8 hrs.

Module - II.

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives – Formalin – 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 5 hrs.

PRACTICALS

Total: 14 hrs.

1. Parts of microscope and its operation.

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

3. Measurement of pollen size 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.

THIRD SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 3: MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

Code: BOT3B03T

[Total 90 hours: Theory 54, Practical 36]

MICROBIOLOGY Theory- 18 hrs. [1 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, Genetic recombination in bacteria, Economic importance of bacteria
3. Viruses – Classification, architecture and multiplication, Bacteriophages, TMV, retroviruses- HIV, 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: 9 Hrs.)

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

References

1. Dubey 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; 18 hrs.) [1hr. 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: 9 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: 9 hours) [½hr. per week]

1. Introduction: Type of Interaction between the components symbiosis – mutatism.

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: 9 hrs.)

1. Identification of different forms of Lichen 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

PLANT PATHOLOGY

Theory: 9 hrs. [½ hr. 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 (9 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

1. Agros, G.N. 1997. Plant Pathology (4th ed) Academic Press.
2. Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Mehrotra, R.S. 1980. Plant Pathology – TMH, New Delhi.

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

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

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

FOURTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE - 4: PHYCOLOGY, BRYOLOGY, PTERIDOLOGY,

Code: BOT4B04T

[Total 90 hours: Theory 54, Practical 36]

PHYCOLOGY Theory-23 hrs [1 ¼ hrs. 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: 9 hrs.)

Identify the vegetative and reproductive structures of the types studied.

1. Familiarizing the technique of algal herbarium sheets.

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.

BRYOLOGY Theory-9 hrs [½ hr. per week]

Module - I

1. Introduction, general characters and classification by Stotler & Stotler (2000, 2008) 1.hr.
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required)
   a. Riccia (Marchantiophyta)
   b. Anthoceros (Anthocerotophyta)
   c. Funaria (Bryophyta) 6 hrs.
3. Evolution of gametophyte and sporophyte among Bryophytes 1 hr.
4. Economic importance of Bryophytes $^1/_2$ hr.
5. Fossil Bryophytes $^1/_2$ hr.

PRACTICALS

1. Riccia – Habit, Anatomy of thallus, V.S. of thallus through antheridium, archegonium and sporophyte.
1. Anthoceros- Habit, Anatomy of thallus. V.S. of thallus through antheridium, archegonium and sporophyte.
2. 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. Crandall-Stotler, B. and R. E. Stotler. 2000. In A. J. Shaw and B. Goffinet, Bryophyte Biology, Cambridge University Press.
4. Crandall-Stotler, B. and R. E. Stotler. 2008. In A. J. Shaw and B. Goffinet, Bryophyte Biology, Cambridge University Press (Revised edition)

5. Gangulee Das and Dutta., College Botany Vol.1, Central Book Dept. Calcutta.
6. Parihar, N.S. An Introduction to Bryophyta Central Book Depot, Allhabad, 1965.
7. Shaw.J.A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.
8. Smith G.M. 1938, Crytogramic Botany Vol.II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.
9. Sporne K.R.,1967, The Morphology of Bryophytes. Hutchinson University Library, London.
10. Vasishta B.R. Bryophyta. S. Chand and Co. New Delhi.
11. Watson E.V. 1971, The structure and life of Bryophytes. Hutchinson University Library, London.
12. Gangulee, H.C. and Kar A.K. College Botany Vol.II, New Central Book Agency, Calcutta.

PTERIDOLOGY Theory-22 hrs [1 ¼ hrs. per week]

Module- I

1. Introduction, general characters and classification (Smith et al., 2008 – brief outline only) 2 hrs.
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required)
   a. *Selaginella* (Lycopsida) 2 hrs.
   b. Psilotum (Psilotopsida) 2 hrs.
   c. *Equisetum* (Equisetopsida) 2 hrs.
   d. *Pteris* & *Marsilea* (Polypodiopsida) 4 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 10 hrs.

PRACTICALS

Total: 18 hrs. [1 hr. perweek]

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

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

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. Rashid, A. 1976, An Introduction to Pteridopyta, Vikas publ. Co. New Delhi.
6. Ranker, T.A. & Haufler, C.H. (eds.), 2008. *Biology and Evolution of Ferns and Lycophytes*. Cambridege University Press.
7. Mehltreter, K., Walker, L.R. & Sharpe, J.M. (eds.) 2010. *Fern Ecology*. Cambridge University Press.
8. Smith, A.R., Pryer, K.M., Schuttpelz, E. Korall, P., Schnelder, H. and Wolf., P.G. 2006. A Classification for extant ferns. *Taxon* 53: 705-731.
9. Smith, A.R., Pryer, K.M., Schuettpelz, E. 2008. Fern classification. *In*: T.A. Ranker and C.H. Haufler (eds.). *Biology and Evolution of Ferns and Lycophytes*. Cambridge University press, U.K. pp. 45-67.
10. Smith G.M. 1938, Cryptogamic Botany Vol. .II. Bryophytes and Pteridophytes. McGraw Hill Book Company, London.
11. Sporne, K.R. 1967, Morphology of Pteridophytes – Hutchi University Library, London.
12. Sreevastava, H.N. A text book of Pteridophyta.
13. Vasishta B.R. 1993, Pteridophyta – S. Chand and Co., New Delhi.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE -5: GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY, EVOLUTION

Code: BOT5B05T

[Total 99 hours: Theory 63, Practical 36]

GYMNOSPERMS

Theory- 19 hrs. [1hr. per week]

1. Introduction, General characters and classification of Gymnosperms (Sporne, 1965) 3 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* 12 hrs.
3. Evolutionary trends in Gymnosperms; Affinities of Gymnosperms with Pteridophytes and Angiosperms 3 hrs.
4. Economic importance of Gymnosperms. 1 hr.

PRACTICALS Total: 18 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. 6 hrs.
2. Pinus- branch of unlimited growth, spur shoot, T.S. of stem and needle, malecone and female cone, L.S. of male cone and female cone, seed. 6 hrs.
3. Gnetum- Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed. 6 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 [Total: 9 hrs.]

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 ½hr.

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 ½ hr.

PRACTICALS Total: 9 hrs.

1. Fossil Pteridophytes - Rhynia stem, Lepidodendron, and Calamites
2. 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.

PHYTOGEOGRAPHY [Theory: 15 hrs]

1. Definition, concept, scope and significance of phytogeography. 1 hr.
2. Patterns of plant distribution - continuous distribution and discontinuous distribution, vicarism, migration and extinction 3 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. 2 hrs.

PRACTICALS (9 hrs.)

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

References

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: 20 hrs.]

1. Origin of Earth – Introduction; Evidences of organic evolution; Evidences from Morphology, Anatomy, Embryology, Palynology, Genetics and Molecular Biology. 3 hrs.
2. Condensation and Polymerisation; Protenoids and Prions – Oparin's 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 de Vries, Neo-Darwinism and its objection; Arguments and support for Darwinism. 4 hrs.
5. Genetic Constancy and Creation of Variability : Cell divisions and genetic constancy; – Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift. 5 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.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-6: ANGIOSPERM MORPHOLOGY& SYSTEMATICS

Code: BOT5B06T

[Total 99 hours: Theory 63, Practical 36]

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

I Morphological description of a flowering plant; Plant habit 1 hr.

a. Root: Types - Tap root, fibrous root; Modifications - Definition with examples - Storage, aerial, pneumatophores, buttress 1 hr.

b. Stem: Habit - Acaulescent, Caulescent, Cespitose Prostrate, Repent, Decumbent, Arborescent, Suffrutescent (Definition with examples only); Modification - Underground, Aerial, Subaerial with examples 2 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. 3 hrs.

II Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium verticillaster, thyrsus) 3 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. 4 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. 4 hrs.

PRACTICALS (Total: 9 hours)

1. Students are expected to identify the types mentioned in the syllabus.
2. The typical examples 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: 45 hrs. [2 ½ 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; Phylogenetic systems;Phenetics; Cladistics (Brief account of various phases). 3 hrs.

3. Systems of classification: Artificial – Linnaeus; Natural – Benthem and Hooker (detailed study); Phylogenetic – Hutchinson; Angiosperm Phylogeny Group system – (introduction only). 4 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 and Poaceae. 16 hrs.

Module- III

1. Taxonomic structure – Hierarchy; Concepts of taxa: Species – Biological, Phenetic and Phylogenetic; Genus; Family. 2 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. 3 hrs.
3. Contributions of eminent Taxonomists viz Hendrich van Rheed, WilliamRoxburg, 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. 5 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; TBGRI and Malabar botanicl Garden, Olavanna , Kozhikode. 3 hrs.

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

PRACTICALS Total: 27 hrs.

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

1. Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
2. Sporne, K.R. 1974. Morphology of Angiosperms. Hutchinson University Press London.

3. Radford, A.E. 1986. Fundamentals of plant systematics. Harper & Row Publishers, New York.
4. NaiK, V.N. Taxonomy of Angiosperms. TATA McGraw Hill, New Delhi
5. Burkill, I.H. 1965. Chapters on the History of Botany in India, Delhi.
6. Gurucharan Singh, 2001. Plant systematics - Theory and Practice. Oxford & IBH, New Delhi.
7. Davis, P.H. & V.H. Heywood, 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd Ltd., London.
8. Henry, A.N. & Chandrabose An aid to International Code of Botanic Nomenclature.
9. Jeffrey, C. 1968. An introduction to Plant Taxonomy, London.
10. Simpson, M.G. 2006. Plant Systematics. Elsevier Academic Press, London
11. Stuessy, T.F. 1990. Plant Taxonomy – The systematic evaluation of Comparative data. Columbia University Press, New York.
12. Sharma, B.D. et al. (Eds.) Flora of India vol. I. Botanical Survey of India, Calcutta.
13. Sambamurthy A..S.S. 2005;Taxonomy of Angiosperms, i.K. International Pvt. Ltd, New Delh.
14. Pandey, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.
15. Sharma, O.P. 1996. Plant Taxonomy. TATA McGraw Hill, New Delhi.
16. Clive A. Stace 1991: Plant Taxonomy and Biosystematics, Cambridge University Press.
17. Bharati Bhattacharyya 2009; Systematic Botany, Narosa Publishing House Pvt. Ltd., New Delhi.

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

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 7: EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY, HORTICULTURE

Code: BOT5B07T

[Total 99 hours: Theory 63, Practical 36]

EMBRYOLOGY (Theory - 18 Hrs.) (1 hr. per week)

1. Typical Angiosperm flower – morphology of floral organs 1 hr.
2. Anther - structure, dehiscence; microsporogenesis; male gametogenesis 3 hrs.
3. Ovule - structure, types; Megasporogenesis; Female gametogenesis: Monosporic, bisporic and tetrasporic. Structure of typical embryosac, Polygonum, Allium and Adoxa type 7 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 Mococot embryo - Sagittaria 3 hr.
7. Polyembryony - causes, types and significance 1 hr.
8. Parthenocarpy – induction and importance 1 hr.

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

1. Bhojwani S & S.P. Bhatnagar 198. The Embryology of Angiosperms. Vikas Publishing House (P) Ltd.
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-RastogiPublications, 'Gangothri' Sivaji road, Meerut-

PALYNOLOGY (12 hrs.)

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

PRACTICALS (Total - 7 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.

ECONOMIC BOTANY (6 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, Corm, 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, Asafetida
14. Spices – Pepper, Ginger, Cardamom, Clove, Nutmeg, Allspice, Cinnamon
15. Medicinal – *Adhatoda*, *Catharanthus*, *Phyllanthus*, *Rauvolfia*, *Aloe*,

PRACTICALS (Total: 3 hrs)

1. Students shall be able 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 make any illustrations but make a table in the record giving the details of the items mentioned in the theory syllabus. 3 hrs.

ETHNOBOTANY [Theory: 6 hrs.]

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

PRACTICALS [Total: 3 hrs]

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

1. Jain. S. K. 1981. Glimpses of Indian Economic Botany. Oxford
2. Baker. H.g. 1970. Plant and Civilization.
3. Jain. S. K. 1995. A Manual of Ethnobotany. Scientific Publishers , Jodhpur.
4. Cotton, C.M. 1996. Ethnobotany – Principles AND Applications. Wiley and Sons.
5. Bendre Kumar 2000: Economic Botany' Rastogi Publcations, Shivaji road, meerut.

HORTICULTURE Theory: 21 hours (1 ¼ 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.

7 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).

7 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

7 hrs.

PRACTICALS Practical 14 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.
6. A brief report of item no. 5 may be recorded.
7. Students are expected to submit at least five articles/specimens/ photographs of horticultural significance at the time of practical examination Paper-I

References

1. Nishi Sinha: Gardening in India, Abhinav Publications, New Delhi.
2. Andiance and Brison. 1971. Propagation Horticultural Plants.
3. Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi.
4. Katyal, S.C., Vegetable growing in India, Oxford, New York.

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

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

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

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

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

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

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

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

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

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

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

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

17. George Aquah 2005: Horticulture

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-8: GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY AND MOLECULAR BIOLOGY

Code: BOT5B08T

[Total 99 hours: Theory 63, Practical 36]

GENERAL INFORMATICS & BIOINFORMATICS

Theory: 13 hrs. [3/4 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.

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.

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.

Module- IV

1. Introduction to Bioinformatics, scope and relevance.
2. Biological data bases and 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

Module- V

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)

Module- VI

A brief account on

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

PRACTICAL

Total: 9 hrs.

1. Femiliarising various search engines and sites.
2. Familiarizing with the different data bases mentioned in the syllabus.
3. Molecular visualization using Rasmol.
4. Blast search of nucleotide sequences.

Reference

1. Jin Xiong 2006: Essential bioinformatics, Cambridge University Press, Replika Press Pvt. Ltd.

MOLECULAR BIOLOGY

Theory -23 Hrs. [1 ¼ hrs per week]

Module – I.

1. Nucleic acids - 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 7 hrs.
2. RNA- structure, types and properties. 2 hrs.
3. Gene action - One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis; concept of colinearity; modern concept of gene-cistorns, recons and mutons 3 hrs.
4. Genetic code - Characters of genetic code 2 hr.

5. Central dogma protein synthesis; Transcription, post-transcriptional modification of RNA, translation; Teminism. 3 hrs.
6. Gene regulation in prokaryotes - operon concept, (Lac operon, trp. operon) 1 hr.
7. Gene regulation in eukaryotes (brief account) 2 hrs.
8. Mutation-spontaneous and induced; causes and consequences. Types of mutagens and their effects. Point mutations- molecular mechanism of mutation-Transition, Transversion and substitution 3 hrs.

References

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
4. V. Malathi, 2010. Essentials of Molecular Biology, Pearson Education Inc.
5. Waseem Ahmad, 2009. Genetics and Genomics. Pearson Education Inc.

INTRODUCTORY BIOTECHNOLOGY

Theory: 27 hours [1 ½ 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. 8 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 7 hrs.

Module -III

a. 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.

b. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, electroporation, microinjection, biolistics. Agrobacterium mediated gene transfer gene library, gene banks. 8 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,

d. Flavr Savr Tomato, Virus, herbicide resistant crops, Edible vaccines.

e. Environment- Bioremediation- use of genetically engineered bacteria-super bug.

f. Industry- Horticulture and Floriculture Industry, production of vitamins, amino acids and alcohol. 4 hrs.

PRACTICALS [Total: 27 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 nearby and submit a duly certified detailed record of the same during the practical examination.

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; structre 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. 6 hrs

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. 6 hrs.

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: BOT5D02

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

MODULE – IV. ECONOMIC BOTANY

1. Genreal account on various plants of economic importance
2. Studythe Binomail, Family, Morphology of the useful part of the following plants.
   a. Cereals and Millets – Rice, Wheat
   b. Pulses -Greengram, Bengalgram, Blackgram
   c. Beverages – Coffee, Tea, Cocoa.
   d. Fibre – Coir, Cotton
3. Timber – Teak, Rose wood, Jack
4. Spices – Pepper, Ginger, Cardamom
5. Medicinal – Adhatoda, Phyllanthus, Rauvolfia
6. Oil- coconut, Gingelly
7. Ornamentalants of economic importance – Rose, jasmine
8. Fruit – Mango, Banana 10 hrs.

References

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

2. Andiance and Brison. 1971. Propagation Horticultural Plants.

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

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

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

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

6. Premchand, Agriculture and Forest Pest and their Management,OxfordPublication.

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

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

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

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

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

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

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

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

15. 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: BOT5D03

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. Micropropagation - Different methods – axillary bud proliferation, direct and Indirect organogenesis and somatic embryogenesis.
2. Different phases of micropropagation – hardening, transplantation and field Evaluation: Advantages and disadvantages of micro propogation.
3. Soma clonal variation. 10 hrs.

Module – IV

1. Applications of plant tissue culture: Micropropagation; 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

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

References

1. Dixon, R.A. & R.A. Gonzales. 1994. Plant Cell Culture – A Practical Approach (2nd Ed) Oxford University Press.
2. Mantel & Smith (1983) Plant Biotechnology. Cambridge University Press
3. Mantel, S. H, Mathew, J.A. et al. 1985 An introduction to Genetic Engineering in plants. Blackwell Scientific Publishers, London.
4. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.
5. Hammond, J., Megary, P et al. 2000. Plant Biotechnology. Springerverlag.
6. Gamborg, O.L. & G.C. Philips (Eds.) 1995. Plant Cell, Tissue and Organ Culture Fundamental Methods. Narosa Pulishing House, New Delhi.
7. einert & Bajaj Plant Cell, Tissue and Organ Culture.
8. 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- 9: GENETICS AND PLANT BREEDING

Code: BOT6B09T

[Total 90 hours: Theory 54, Practical 36]

GENETICS Theory: 40 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 anemia in Human beings. 5 hrs.
   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. 3 hrs.

4. Quantitative inheritance / polygenic inheritance / continuous variation- Skin color in human beings, Ear size in maize. 3 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. 6 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. 4 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 3 hrs.

PRACTICAL

Total: 27 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: 14 hrs. [¾ hr. 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

1. 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.

    d. Heterosis breeding - genetics of heterosis and inbreeding depression.

    e. Mutation breeding – methods,- achievements.

    f. Polyploidy breeding

    g. Breeding for disease and stress resistance 10 hrs.

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

PRACTICAL 9 hrs

1. Techniques of emasculation and hybridization of any bisexual flower.
2. Floral biology of Paddy, any one Pulse and Coconut tree.
3. Visit to a plant breeding station and submission of its report.

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: PLANT PHYSIOLOGY AND METABOLISM

Code: BOT6B10T

[Total 72 hours: Theory 54, Practical 18]

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? Antitranspirants.

3. Absorption of water by transpiration pull and cohesion of water molecules. Radial movement of water through root. Soil-plant-atmosphere continuum of water. 9 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. 6 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. 8 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. 4 hrs.
3. Translocation and distribution of photo assimilates. Composition of phloem exudates. Mechanism of phloem transport. Phloem loading and unloading; pressure flow hypothesis. 4 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. 6 hrs.

Module – V

1. Intermediary metabolism: anabolism, catabolism, amphibolic pathways and anapleurotic reactions. 3 hrs
2. 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. 3hrs
3. Oxidation of fatty acids. β oxidation of saturated fatty acids in plants. Glyoxylate cycle. 3 hrs
4. Biosynthesis of saturated fatty acids in plants. Involvement of fatty acid synthase complex and acyl carrier protein. 3 hrs
5. Oxidation of amino acids and entry to TCA cycle. 2 hrs
6. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers function as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis. Shuttle systems. 3 hrs

Practicals 18 hrs.

Students should familiarize experiments and details must be recorded. Any of the eperiment 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.

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-11: CELL BIOLOGY AND BIOCHEMISTRY

Code: BOT6B11T

[Total 90 hours: Theory 54, Practical 36]

CELL BIOLOGY Total: 27 hrs. [1 ½ hr. per week]

Module – I.

1. Architecture of cells. Prokaryotic and Eukaryotic cells. 2 hrs.

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

   k. Vacuole 7 hrs.

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

4. Chromosomes - Morphology, classification, Centromere and Telomere, Chemical Composition and organization. 3 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: 9 hrs.]

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

2. Calculation of mitotic index

3. Demonstration of meiosis in Rhoeo/Chlorophytum/ Maize and 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.

BIOCHEMISTRY Total: 27 hrs. [1 1/2 hrs. per week]

1. Macromolecules-building block biomolecules - metabolic intermediates-precursors). 3 hrs.
2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates. 3 hrs.
3. Lipids. Classification. Complex lipids, Simple lipids and derived lipids; Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids. 4 hrs.
4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; zwitterions, Dipeptides. 3 hrs.
5. Proteins: Primary, secondary, tertiary and quarternry structures of proteins. Native comformation and biological functions of proteins. Denaturation and renaturation. 4 hrs.
6. Nucleotides structure of nucleotides. Functions of nucleotides and nucleotide derivatives. 3 hrs.
7. Secondary metabolites. A brief account of secondary metabolites, physiological roles. Significance: ecological importance. 3 hrs.
8. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, covalently modulated enzymes. Isoenzymes. 4 hrs.

PRACTICALS 27 hrs.

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. Millon's test for tyrosine

j. Hopkins- Cole test for tryptophan

k. Biuret test for peptide linkage and proteins

2. Quantitative estimation of protein by Biuret method.

3. 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-12: ENVIRONMENTAL SCIENCE
Code: BOT6B12T

[Total 72 hours: Theory 54, Practical 18]

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

Module - I

1. Ecosystem – Definition ; abiotic and biotic factors; trophic structure; Food chain and food web; Ecological 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.

ELECTIVE PAPERS

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-11: Elective-1: GENETIC ENGINEERING

Code: BOT6B13T

[Total: 90 hrs. Theory 54 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

12 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

15 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

15 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

12 hrs.

Practical: 36 hours

{ The entire 90 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practicals may be done during theory classes}

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 selecting this elective are supposed to procure the required facilities 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

Record of the practical works done together with the detailed report of the Biotechnlogy Laboratory visit should be duly certified and submitted for the valuation at the time of practical examination.

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: ADVANCED ANGIOSPERM SYSTEMATICS

Code: BOT6B11T

[Total: 90 hrs. Theory: 54 hrs. , Practical: 36 hours]

Module -I Principles of Angiosperm Taxonomy

1. Scope and importance of Taxonomy.
2. The history of taxonomy- Ancient classification; Evolution of different concepts in taxonomy. 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 (Brief account only)

12 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.
5. Digital resources in taxonomy: Softwares, Databases, Online tools; use of TROPICOS, IPINI, Virtual herbaria, Digital flora/databases of Flora of Kerala. 22 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

5 hrs.

Module – IV Taxonomic review of selected families

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, Meliaceae, Combretaceae, Lythraceae, Scrophulariaceae, Convolvulaceae, Bignoniaceae, Verbenaceae, Amaranthaceae, Urticaceae, Amaryllidaceae, Arecaceae, Cyperaceae 15 hrs

Practicals: 36 hrs.

{ The entire 90 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practicals may be done during theory classes}

1. Identification of locally available plants belonging to the families mentioned under module - IV using local floras.
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 workout at least one member of the every families mentioned in module IV, and has to make suitable sketches/illustrations manually or digitally, and record the same for valuation at the time of Practical examination as part of submission.**

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: BOT6B15T

[Total: 90 hrs. Theory 54 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. Activities – exploration, conservation, evaluation, documentation and utilization.
2. Agencies involved in plant genetic resources activities – NBPGR and IPGRI
3. 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, TBGRI

8 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 4 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 7 hrs.

Module- V.

I. Breeding for resistance to abiotic 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. 15 hrs

II. Breeding for resistance to biotic stresses

1. 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.

2. 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. 10 hrs.

Practicals 36 hrs.

{ The entire 90 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practicals may be done during theory classes}

1. Visit a leading breeding station in South India and record a detailed report.
2. Make illustrations on the floral biology of Rice, Cashew and Solanum spp.
3. Demonstration of hybridization in Rice, Cashew and *Solanum* and describe the procedure.
4. Study the variability under induced stress (salinity and moisture) of seedlings of rice and green gram and record the observations.

Record of the practical works done together with the detailed report of the plant breeding station visit should be duly certified and submitted for the valuation at the time of practical examination.

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.
4. Allard, R W. 1960. Principles of Plant Breeding. John Wiely & Sons, New York.

5. Chahal, G S & S S Gosal, 1994. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.

6. Chrispeels M J and Sadava, D E. 1994. Plants, Genes and Agriculture. Jones and Bartlet Publishers, Boston, USA.

MODEL QUESTIONS (Theory)

FIRST SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core Course – I

CORE COURSE 1 – PLANT ANATOMY

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 1 – 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

SECOND SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core Course – 2

RESEARCH METHODOLGY & MICROTECHNIQUE

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 2 – 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

THIRD SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core course- 3

MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

Model question- Subject wise distribution of marks

Type of questions	Microbiology	Mycology	Lichenology	Pathology	Total
1 mark	3	3	2	2	10x1=10
2 marks	3	3	2	2	10x2=20
5 marks	2	2	1	1	6x5 =30
10 marks	1	1	-	1	2x10=20

MODEL QUESTION PAPER

CORE COURSE 3 – MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

Time 3 Hours Total: 80 marks

PART A

Answer all the questions

1. A virion is ----------
2. Lichen grown on the trees are called
3. Quick wilt of Pepper is caused by
4. Apothecium is the fruit body of ----------
5. Asexual reproductive structure in Lichen is ----------
6. Give an example of SCP.
7. What is chlorosis?
8. Which bacterium obtain energy from the following reaction $NO_2 + ½\ O_2 \rightarrow NO_3$ + energy
9. Name a heteroecious fungus.
10. What is karyogamy?

10x1=10 marks

Part B

Answer all questions

11. Define facultative saprophyte
12. Write notes on symbiosis with an example
13. What is dikaryotization?
14. Distinguish between smut and rust
15. Write notes on Rhizophere
16. Describe apothecium in *Peziza*
17. What is isidium?
18. What is mycoplasma? Name a disease caused by it.
19. What are plasmids?
20. Define systemic fungicide.

10x2=20 marks

Part C

Answer any six of the following

21. Write a brief account of the features of ascomycetes.
22. Give a brief account of Gram staining
23. Enumerate the economic importance of Fungi
24. Briefly explain physiology of parasitism
25. Briefly explain reproduction in lichens
26. Describe the gene transfer methods in bacteria

6x5= 30marks

Part D

Answer any two of the following

27. Briefly explain the life cycle of a facultative saprophyte with special emphasis on damping off of seedling
28. Describe the structure and reproduction of Bacteriophage.
29. With the help of diagrams describe the reproduction, and life cycle of *Mucor*.

2x10= 20 marks

FOURTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core Course- 4

PHYCOLOGY, BRYOLOGY&PTERIDOLOGY

Model question- Subject wise distribution of marks

Type of questions	Phycology	Bryol.	Pterido	Total
1 mark	4	2	4	10x1=10
2 marks	4	2	4	10x2=20
5 marks	3	2	3	6x5 =30
10 marks	1	1	1	2x10=20

MODEL QUESTION PAPER

CORE COURSE – 4: PHYCOLOGY, BRYOLOGY, PTERIDOLOGY,

Time 3 Hours Max. 80 marks

PART A

Answer all the questions

1. Name a marine alga.
2. Name a vascular cryptogam.

3. What is the type of stele of *Pteris* Rhizome
4. Male sex organ in *Chara*
5. Floridean Starch is the energy reservoir of the Class of algae ----------
6. Sporangium develops from a single initial cell is called ----------
7. *Anthoceros* is commonly known as ----------
8. Name a plant with Polystelic stem ----------
9. Which is the most primitive type of thallus in Algae.
10. Name the most economically important bryophyte. 10 x 1 =10 marks

Part B

Answer all questions

11. Define Plakea
12. What is Nannandrium?
13. Stele in *Marsilea* rhizome
14. Ligule of *Selaginella*
15. The most primitive type of sexual reproduction in Algae.
16. Define Apospory. Give an example.
17. Spore dispersal mechanism in *Funaria*
18. What are resurrection plants? Give example.
19. Primitive characters of *Riccia* sporophyte.
20. What are the types of pigments in Phaeophyceae?

10 x 2 = 20 marks

PART C

Answer any six of the following

21. Enumerate the medicinal uses of algae
22. Compare the elaters of *Equisetum* and *Anthoceros*.
23. Write an account on economic Importance of Bryophytes.
24. Explain the reproduction in *Volvox*
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. Heterospory is the beginning of seed habit. Discuss.
28. Give the general characters of Xanthophyceae.

6x5=30 marks

Part- D

Answer any two of the following

29. Explain any two life cycles you have studied in algae with examples.
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

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core Course – 5

GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY & EVOLUTION

Model question- Subject wise distribution of marks

Type of questions	Gymnosperms	Palaeobotany	Phytogeography	Evolution	Total
1 mark	3	2	1	4	10x1=10
2 marks	4	1	3	2	10x2=20
5 marks	2	2	2	2	6x5 =30
10 marks	1		1	1	2x10=20

MODEL QUESTION PAPER

CORE COURSE 5: GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY & EVOLUTION

Time 3 Hours Total: 80 marks

PART A

Answer all the questions

1. Name a plant with manoxylic wood
2. Name a famous Indian Palaentologist
3. Origin of Himalayan Mountain Ranges took place in ---------- era
4. Name a gymnosperm which contains vessels in the xylem ----------
5. The nomenclature of fossil form genus for a stem is ……
6. Gymnosperms resemble Pteridophytes in having ……..
7. The richest sources of fossil is …….
8. Closely related organisms with very different traits have experienced ……..
9. The unit of natural selection is……
10. Reproductive isolation in sympatric speciation develops without ……

10x1=10 marks

Part B

Answer all questions

11. What is amber?
12. Describe the process of fossilization.
13. What is the main function of coralloid roots of Cycas?
14. How does lateral conduction take place in *Cycas* leaflet?
15. Write a short note supporting Darwinism.
16. Describe the mesophyll tissue of *Pinus* needle.
17. What is adaptive radiation?
18. What is meant by discontinuous distribution? Explain the various theories.
19. What is palaeoendemic? Give an example.
20. Comment on the climates of India.

10x2=20 marks

Part C

Answer any six of the following

21. Write an account on angiosperm characters in *Gnetum*.
22. Give an account on migration and extinction.
23. Give an account of a Paleobotanical Institute in India.
24. With the help of labelled diagram, describe the structure of *Gnetum* ovule.
25. Describe the process of fossilization
26. Describe the methods of speciation.
27. What id continental drift?
28. Describe Williamsonia.

6x5= 30marks

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. Describe the various patterns of plant distribution.
31. Write an essay on the evidences of organic evolution. 2x10= 20 marks

Core Course – 6

ANGIOSPERM MORPHOLOGY, PLANT SYSTEMATICS

Model question- Subject wise distribution of marks

Type of questions	Systematics	Angiosperm Morphology	Total
1 mark	6	4	10x1=10
2 marks	6	4	10x2=20
5 marks	4	4	6x5 =30
10 marks	2	1	2x10=20

MODEL QUESTION PAPER

CORE COURSE – 6: ANGIOSPERM MORPHOLOGY, PLANT SYSTEMATICS,

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 OTU stands for
6. Caryopsis is the fruit seen in the family
7. Infloresecence in sunflower is ----------
8. Classification based on chemicals present in the taxon is ----------
9. *Tridax* shows ---------- stem.
10. What is holotype? 1 x 10= 10 marks

PART - B

Answer all questions

11. What are root buttresses?
12. What is a Flora?
13. What is epigyny?
14. Write the salient features for Apocyanaceae
15. Mention the inflorescence of Asteraceae
16. What is meant by Binomial nomenclature?
17. Distinguish between aggregate fruit and multiple fruit.
18. Describe coenantium inflorescence.
19. Give the differences between indented key and bracketed key.
20. Give the floral features of Poaceae.

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.
26. Give the morphology of tendrils in Cucurbitaceae.
27. Draw the floral diagram and give the floral formula of a flower in Rubiaceae.
28. Describe adnation in Solanaceae.

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 – 7

EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY AND HORTICULTURE

Model question- Subject wise distribution of marks

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

MODEL QUESTION PAPER

CORE COURSE 7-EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY AND HORTICULTURE

Time 3 Hours **Max. 80 marks**

Part-A

(Answer all questions)

1. Name the anther wall layer with fibrous thickening.
2. Define ethnobotany.
3. What is pollinium?
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 the binomial of clove.

(1x10= 10 marks)

Part-B

Answer all questions

11. Name any two fibre yielding plant and their binomial
12. What are clones?
13. What is double fertilization?
14. What is CEC? How does it affect soil fertility?
15. Explain air layering.
16. Discuss the role of synergids
17. Define Areo and Melitto palynolgy
18. Name two plants of ethnobotanical significance
19. Comment on the formation of humus.
20. What is Pollenkit substance?

10x2=20 marks

Part-C

Answer any six of the following

21. Name any two fruit yielding plants, binomials and their families.
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 Polyembryony.
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. Briefly describe South Indian Tribes.

6x5=30 marks

Part D

Answer any two of the following

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 - 8

COURSE – 8: 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	2	4	4	10x1=10
2 marks	3	4	3	10x2=20
5 marks	2	3	3	6x5 =30
10 marks	1	1	1	2x10=20

Model Question not included

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

Core Course - 9

GENETICS & PLANT BREEDING

Model question- Subject wise distribution of marks

Type of questions	**Genetics**	**Plant breeding**	Total
1 mark	7	3	10x1=10
2 marks	6	4	10x2=20
5 marks	5	3	6x5 =30
10 marks	2	1	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE – 9: GENETICS & PLANT BREEDING

Code: BOT6B09T

Time 3 Hours Total 80 marks

Part- A

Answer all the questions

1. What are alleles?
2. Define genotype.
3. Who discovered incomplete dominance in *Mirabilis*?
4. If the father is of A group and the mother is of O group, the child will be …….. group.
5. Give an example of an intergeneric cross
6. CPCRI is involved in improvement of ----- crops
7. Dihybrid Testcross ratio is ----------
8. Complementary interaction in Sweet Peas gives an F_2 ratio ----------
9. The F_2 ratio of recessive epistasis is ----------
10. Father of green revolution in India is ----------

10x1=10 marks

Part - B

Answer all questions

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 codominance and incomplete dominance.
17. Explain the complementary gene action.
18. Define heterosis.
19. State Hardey - Weinberg Law.
20. What are multiple alleles? 10x2=20 marks

Part C

Answer any six of the following

21. What is an operon? Explain the functioning of lac operon in Prokaryotes.
22. Differentiate between sex-limited and sex-influenced traits with suitable examples.
23. Explain the hybridization techniques adopted in Rice.
24. Give an account of polyploidy and their role in plant breeding.
25. Explain the ratio 12 : 3 : 1
26. Write an account on plant genetic resources.
27. Explain genic balance theory of sex determination in *Drosophila*.
28. Describe extranuclear inheritance with suitable example. 6x5=30 marks

Part - D

Answer any two of the following

29. Write an essay on modern tools of genetic engineering and Genetically Modified foods.
30. Describe Quantitative inheritance with suitable examples.
31. Give an account of Linkage and crossing over. Explain the method of finding out the distances between three genes by using a three point test cross. 2x10=20 marks

Core Course – 10

PLANT PHYSIOLOGY AND METABOLISM

Model question- Subject wise distribution of marks

Type of questions	Plant Physiology	Metabolism	Total
1 mark	6	4	10x1=10
2 marks	6	4	10x2=20
5 marks	5	3	6x5 =30
10 marks	2	1	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-10: PLANT PHYSIOLOGY AND METABOLISM.

Code: BOT6B10T

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 a plant that shows seismonastic movement
4. Fatty acid biosynthesis in germinating seeds takes place in ----------
5. ---------- is a method of breaking dormancy
6. Name the first enzyme involved in glycolysis.
7. Which is the hormone involved in stomatal closure.
8. Which is the pigment involved in the perception of photoperiodic signal.
9. Which compound is removed during each cycle of ß-oxidation of fatty acids.
10. Name a carrier involved in the uptake of mineral elements by plants.

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. What is nutation?
17. Name two electron carriers in Photosynthesis.
18. Name the stimulus in thigmotropism.
19. What is meant by synergistic action?
20. What is 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. Describe the glycolytic pathway with the help of a diagrammatic representation.
25. How does biosynthesis of fatty acids take place in plants?
26. Give an account of chemiosmotic hypothesis.
27. Give an account of the amphibolic nature of citric acid cycle.
28. Describe cohesion-tension theory. Give its merits and demerits.

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. Briefly describe the process of oxidative phosphorylation in plants.
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 – 11

CELL BIOLOGY & BIOCHEMISTRY

Model question- Subject wise distribution of marks

Type of questions	**Cell biology**	**Biochemistry**	Total
1 mark	5	5	10x1=10

2 marks	5	5	10x2=20
5 marks	4	4	6x5 =30
10 marks	2	1	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE - 11: CELL BIOLOGY & BIOCHEMISTRY

Code: BOT6B11T

Time 3 Hours Total 80 marks

Part- A

Answer all the questions

1. The non-sticky end of a chromosome is called ----------
2. Give an example of a nonsaponifiable lipid.
3. Nucleus was discovered by ----------
4. The giant nature of Salivary gland chromosome is due to ----------
5. The enzyme acid phosphatase serves as an excellent marker for ----------
6. The precursor for the biosynthesis of IAA is ----------
7. Name a second messenger in hormonal regulation.
8. The repeating bond in amylose is ----------.
9. Which organelle is not bounded by a membrane?
10. The type interaction in the secondary structure of proteins is ----------

10x1=10 marks

Part - B

Answer all questions

11. What is zwitterion?
12. Mention the features of nucleosomes.
13. What is aldose?
14. What are isoenzymes? Give an example.
15. What are the functions of vacuoles?
16. Differentiate between purines and pyrimidines.
17. Mention any two characteristic features of Fluid-Mosaic Model.

18. Write any two applications of steroids.
19. Describe the different components of Golgi complex.
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 cytoskeleton? Explain the function of cytoskeleton.
24. Differentiate between furanose and pyranose forms of sugars.
25. Explain the tertiary structure of proteins.
26. Give an account of polyploidy and their role in plant breeding.
27. Explain the structure and functions of phospholipids.
28. What are coenzymes? Give an example. 6x5=30 marks

Part - D

Answer any two of the following

29. Give the IUB classification of enzymes. Explain the mechanism of enzyme action and add a note on the regulation of enzyme activity
30. With the help of labelled diagrams, explain the process of meoisis I.
31. Give an account of structural abberation and their meiotic consequences.

2x10=20 marks

Core Course – 12

ENVIRONMENTAL SCIENCE

Model question- Subject wise distribution of marks

Type of questions	Module I	Module II	Module III	Module IV	Total
1 mark	3	1	3	3	10x1=10
2 marks	3	2	3	2	10x2=20
5 marks	2	2	2	2	6x5 =30

10 marks	1	1	1	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE - 12: ENVIRONMENTAL SCIENCE

Code: BOT6B12T

Time 3 Hours **Max. 80 marks**

Part- A

Answer all the questions

1. What are biogeochemical cycles?
2. Mention the role of producer in ecosystem?
3. What is phytograph?
4. When huge amount of sewage is dumped into a river BOD of the water will ----------
5. What is meant by density of species?
6. Define in situ conservation.
7. What are green house gases?
8. Mechanical tissues are highly reduced in ----------
9. Define lentic ecosystem?
10. What is acid rain? 1x10=10 Marks

PART B

Answer all questions

11. Define trophic level.
12. Why do some plants grow in saline oil?
13. What happens if ozone gets depleted?
14. Comment on the ecological pyramids.
15. What is keystone species?

16. What are meant by dominance of species?
17. What are e-wastes?
18. Explain ex situ conservation.
19. What is biomagnification?
20. What is qaudrat method? 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 abiotic factors in an ecosystem.
23. Discuss the role of various international organizations on environment protection.
24. Comment on Xerosere.
25. How will you prepare species area curve?
26. Explain the strategy for solid waste management.
27. Give an account on KSBDB.
28. Describe forest as an ecosytem. 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 hydrosere.
31. Give an account of Global environmental changes. 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 (PRACTICAL)

B.Sc. BOTANY CORE PRACTICAL EXAMINATION

Paper-I

Time 3hours Max: 80 marks

1. Prepare a T.S. of the given specimen **A**, draw the ground plan and cellular diagram of a portion enlarged and identify the specimen.
   (Preparation-4; Ground plan-1; Portion enlarged-4; Identification-1)
   10 marks
2. Submit suitable micro preparation of specimens **B, C & D** and identify by giving four important reasons
   (Preparation-4; Identification-1; Reasons - 3) 3x 8 =24marks

3. Determine the pH of the given solution **E** using the pH meter.
   (Procedure_2; calibration- 2; Result-2)
   6 marks
4. Critically comment on **F** & **G**
   (Identification- 2; Comments - 6) 8 marks
5. Determine the diameter/width of the specimen **H** using micrometer
   (Calibration-3; Tabulation- 2; Result-1) 6 marks

6. Identify whether the given bacteria **I** is Gm+ive or –ive and submit the slide for valuation. Submit micro preparation for valuation.
   (Preparation-3; identification-1) 4 marks
7. Identify the disease and list out the symptoms from the specimen given **J**
   (Disease-1; Symptoms- 3) 4 marks
8. Prepare Histogram/Frequency polygon/ using the given data **K**
   OR
   Workout the given problem **K** (Chi square test) 5 marks

9. Identify the type and draw a labeled diagram of the stomata in specimen **L**
   (Preparation-2; diagram-2; identification-1) 5 marks

10. Spot at sight **M, N, O & P** (2x4=8 marks)

Practical Exam-80 marks
Record-20 marks
Submission-10 marks
Total-110 marks

Key to specimens

A. Anatomy (Dicot stem (Primary & Secondary), Monocot stem (Primary), Dicot root (Primary & Secondary.), Monocot root, Anomalous Secondary growth (Boerhaavia, Bignonia & Draceana).

B, C &D Types mentioned under Phycology, Mycology, Bryology or Pteroidology

E. Any solution of known pH

F. & G sporophytes of Riccia and Anthoceros

H. Micrometer and algal filament/pollen grain

I. Lactobacillus/ Rhizobium

J. Any diseased specimen studied under Pathology

K, Statistical data

L. Leaf cuttings of known stomatal type

M,N,O & P – Spotters from Microbiology, phycology, Mycology, Lichenology, Pathology

OR

B.Sc. BOTANY CORE PRACTICAL EXAMINATION

Paper-II

Time: 3hours Max: 80 marks

1. Prepare T. S of the given material **A**, draw labeled diagram and identify the specimen. (Preparation-4, labeled diagram- 3; Identification-1) 8 marks

2. Prepare a T.S. of mature anther **B** and draw a labeled diagram (Preparation-2; Labeled diagram-3) 5 marks
3. Describe the given taxon **C,** determine the family and listout the salient features (Description-5; family-1, salient features – 3) 9 marks

4. Draw a labeled diagram of the V.S. of the flower **D,** and construct the floral diagram and floral formula
(Diagram of VS -3; floral diagram-2; floral formula -1) 6 marks

5. Comment on the morphology of the specimen **E** & **F** (2x2=4 marks)

6. Prepare the explants **G** and demonstrate inoculation 5 marks

7. Demonstrate budding/grafting/layering **H**
(demonstration- 5; Precautions- 2) 7 marks

8. Give the binomial, family and morphology of the following: **I, J, K &L**
(4x2=8 marks)

9. Write down the Binomial and Family of **M&N** (2x3=6 marks)
(Binomial – 2; family-1)
10. Comment on **O, P** &Q (3x3=9 marks)
11. Find out the amino acid sequence if the sequence of template strand **R** is given (Write down the M RNA and Aminoacid sequence) 8 marks
12. Describe the morphological features of the given pollen grain **S**
(Diagram- 2; Description-3) 5 marks

Practical Exam-80 marks

Record-20 marks

Submission-10 marks

Total- 110 marks

Key to specimens

A – Specimens from Gymnosperm

B. Datura anther

C. Families mentioned under theory syllabus

D. Flower & bud

E & F. Specimens of Morphological significance

G. shoot tip/ anther culture

H – Budding/grafting/Layering

I & J Specimens from Economic Botany

K & L Ethanobotany

M & N- Herbarium Sheets

O – Bioinformatics/evolution

P - Molecular Biology

Q– Palaeobotany/ Phytogeographical zone

R - Nucleotide Sequence

S– Hibiscus pollen -

B.Sc. BOTANY CORE PRACTICAL EXAMINATION

Paper-III

Time 3hours Max: 80 marks

1. Prepare a unidirectional chromatogram using the given extract **A** and calculate the Rf value of each component
   (Preparation-5; Calculation and result-3; comments-2) 10 marks

2. Identify the given sample **B** qualitatively 8 marks

OR

3. Determine the quantity of ---------- in ---------ml of the given solution **C** calorimetrically. You are supplied with standard solution of concentration ……. . 8 marks

4. Calculate the stomatal index of the given leaf **D** 4 marks
   (Tabulation- 3; result-1)

5. Submit any two stages of mitosis using the given material **E**
   (Preparation – 4; Diagrams – 2) 2x6=12 marks

6. Determine the dissolved oxygen content of the given water sample **F**
   Calculationn- 5; result-3 8 marks

7. Demonstrate hybridization in specimen **G** 8 marks

8. With the help of suitable diagram describe the floral biology of **H**

9. Comment on **I**,**J, K & L** (3x3=9 marks)

10. Workout the Genetics problems **M & N** (8+5=13 marks)

Practical Exam-80 marks
Record-20 marks
Submission-10 marks
Total- 110 marks

Scheme of Examination

A. Chloroplast extract/Potato tissue

B. Biochemistry

C. Protein solution

D. Leaf segment

E. Onion root tip

F. Water sample

G. Solanum torvum

H –Paddy/ Coconut

I, J, K, L – Cell Biology, genetics, Physilogy, Envt. Science, Plant breeding

M- & N Genetics problems

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**	**2**
	BOT1C01 P	Complementary Course Practical -I	**36 hrs**	**2**	
S -II	BOT2C02 T	Complementary Course II. Cryptogams, Gymnosperms & Plant Pathology	**36 hrs**	**2**	**2**
	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**	**2**
	BOT3C03 P	Complementary Course practical -III	**36 hrs**	**2**	
S-IV	BOT4C04 T	Complementary Course - IV. Plant Physiology, Ecology & Genetics	**54 hrs**	**3**	**2**
	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		Duration of Exams	Marks				Total
				Theory		Practical		
	Theory	Practical		EE	CIE	EE	CIE	
Semester –I BOT1C01 T Anatomy & Micro technique	36	36	3 hrs	64	16	--	--	80
Semester-II BOT2C02 T Cryptogams, Gymnosperms & Plant Pathology	36	36	3 hrs	64	16	--	--	80
Semeser-III BOT3C03 T Morphology, Syst. Botany, Eco. Botany, Plant Breeding & Horticulture	54	36	3hrs	64	16	--	--	80
Semester-III BOC04 Plant Physiology, Ecology & Genetics	54	36	3hrs	64	16	--	--	80

Comp.course Practical Ext..Ex.m -50 Record -10 Submissi on-4	--	--	3hrs	--	--	64[50+10+4]	16	80
Total	180	144		256	64	64	16	**400**

SCHEME OF EVALUATION

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

Theory Examination

Total - 80 marks

External - 64 marks

Internal - 16 marks

Distribution of internal marks [Theory]

Attendance - 4

Test paper - 8

Seminar & assignment 4

Total 16

Practical Examination

Total - 80 marks

External - 64 marks {Ext.Exam -50, Record-10, Submn-4}

Internal - 16 marks

Distribution of internal marks [Practical]

Attendance - 4

Record - 8

Lab involvement & test- 4

Total 16

Submission

Students are expected to submit 8 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 (Xylem & 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 (4th 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.
4.

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 edition, John Wiley A Sons, Inc.
2. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.
3. G. Ray Noggle and George J.Fritz Introductory Plant Physiology Prentice Hall.
4. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd 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.

MODEL QUESTIONS

First Semester Complementary Botany

ANATOMY & MICROTECHNIQUE

Course Code: BOT1C01T

Time: 3hrs Max. 64 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 any seven 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

7 x 2= 14 marks

Part C

(Answer any six of the following)

21. What is meristem? Classify them based on position, origin and function.
21. 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

6 x 4 = 24 marks

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 x 8 = 16 marks

Second Semester Complementary Botany

CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Course Code: BOT2C02T

Time: 3hrs Max. 64 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 any seven 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 7 x 2 = 14 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 4=24 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.

2 x 8 = 16 marks

Third Semester Complementary Botany

MORPHOLOGY, SYSTEMATIC, BOTANY, ECONOMIC BOTANY,

PLANT BREEDING AND HORTICULTURE

Course Code: BOT3C03T

Time: 3hrs Max. 64 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 any seven 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 2 x 7 = 14 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

6x4=24 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.

2x8=16 marks

Fourth Semester Complementary Botany

PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

Course Code: BOT4C04T

Time: 3hrs Max. 64 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 2 x7=14 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 6 x 4 = 24 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. 2 x 8 = 16 marks

B.Sc. Complementary Botany

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) 2 x 3 = 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, 3x1=3 marks

10. Genetics problem –M. 4 marks

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50 marks

Record	10 marks
Submission (Herbarium sheets)	4 marks
Total	64 marks

Key to 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 - Microtechnique, K, & LHerbarium sheet from students' submission.
10. M -Genetics problem