ST.JOSEPH'SCOLLEGE (AUTONOMOUS), DEVAGIRI, CALICUT 8

BSc in Botany-SJCBCSS UG 2015-Scheme and Syllabus- Approved-Implemented-w.e.f 2015 Admissions-Orders issued based on

1. The minutes of the meeting of the Board of Studies in Botany UG held on 26.03.2015

2. The minutes of the meeting of the Academic council of St. Joseph's College, Devagiri(Autonomous) held on 06.04.2015

The Board of Studies in Botany of St. Joseph's College (Autonomous), Devagiri, Calicut 8 finalized the revised syllabus of B.Sc. Botany for implementation w.e.f the Academic Year 2015-2016.).

Sanction has, therefore, been accorded for implementing the Scheme and Syllabus of B.Sc. in Botany under SJCBCSS UG 2014, in the University, w.e.f 2015 Admissions.

Orders are issued accordingly.

(The syllabus is available in the website: www. devagiricollege.org)

Dr. Sibichen. M. Thomas

Principal

ST.JOSEPH'SCOLLEGE (AUTONOMOUS), DEVAGIRI, CALICUT 8

SYLLABUS

for

UNDERGRADUATE PROGRAMME

in

BOTANY

Effective from

2015 Admission

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 undergraduate 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.

Core courses: There are 12 core courses, an elective and an open course in B.Sc. Botany programme with theory examinations for each paper at the end of each semester and three practical examinations – one at the end of the IV semester and two at the end of the VI semester. There is a project work to be carried out by the student during the 5^{th} and 6^{th} semesters. The Student shall submit the project report at the time of practical examination at the end of the 6^{th} semester. Besides the evaluation of the project report there will be a viva voce based on the report.

Complementary courses cover 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: coursewise 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: Chemisrty	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 and Microtechnique	3	100
	Complementary Course: Chemisrty	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 and Plant Pathology	3	100
	Complementary Course: Chemisrty	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 and Pteridology	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: Gymnosperms, Paleobotnay, Phytogeography and Evolution	4	100
	Core Course VI: Angiosperm Morphology and Systematics	3	100
	Core Course VII: Embryology, Palynology, Economic Botany, Ethnobotany and Horticulture	4	100
	Core Course VIII: General and Bioinformatics and Biotechnology and Molecular Biology	4	100
	Open Course	2	50
	Total	**17**	**450**
	Core Course IX: Genetics and Plant Breeding	3	100
	Core Course X: Plant Physiology and Metabolism	3	100

VI	Core Course XI: Cell Biology and Biochemistry	3	100
	Core Course XII: Environmental Science	3	100
	Core Course XIII: Elective	3	100
	Core Practical II	4	100
	Record + Submission (20+10)	--	30
	Core Practical 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 V^{th} and VI^{th} 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 earmarked 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 the Internal Evaluation of the project work		**Criteria for the External evaluation of the Project work**	
Internal (20% of the total)		External (80% of the total)	
Involvement	20	Relevance of the topic Statement of Objectives Methodology	20
Utilization of data	20	Quality of analysis Findings and Recommendations	10
Organization of Report	30	Presentation	20
Viva	30	Viva	50

EXAMINATIONS

There shall be 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 college at the end of

fourth and sixth semester. Project evaluation and viva-voce if, 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. The final evaluation is based on a seven point indirect grading system.A student who cannot secure a grade of at least E is deemed failed in the examination.

Table 5 Seven Point Indirect Grading System

% of marks	***Grade***	***Interpretation***	***Grade Point Average***	***Range of Grade Points***	***Class***
90 and above	A+	Outstanding	6	5.5-6	First Class with distinction
80 to below 90	A	Excellent	5	4.5-5.49	
70 to below 80	B	Very good	4	3.5-4.49	First class
60 to below 70	C	Good	3	2.5-3.49	
50 to below 60	D	Satisfactory	2	1.5.-2.59	Second class
40 to below 50	E	Pass/ Adequate	1	0.5-1.49	Pass
Below 40	F	Failure	0	0-0.49	fail

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 6: Components of Internal Evaluation

Sl.No	Components	Marks
1	Attendance	5
2	Test papers I & II	5+5
3	Assignment	2
4	Seminar	3
	Total Internal Marks	**20**

Table 7: Percentage of Attendance and Eligible Marks

% of Attendance	**Marks**
Above 90 %	**5**
85-89%	**4**
80-84%	**3**
76-79%	**2**
75%	**1**

Table 8: Marks of Test paper for internal evaluation

% of Marks	**Internal Marks**
90% and above	**5.0**
80 to below 90%	**4.5**
70 to below 80%	**4.0**
60 to below 70%	**3.5**
50 to below 60%	**3**
40 to below 50%	**2**
Below 40%	**1**
Below 35%	**0**

EXTERNAL EVALUATION

External evaluation carries 80% marks.

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.

The theory examination has duration of 3 hours. Each question paper has four parts A, B, C & D. 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. 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. Part-C consists of 8 short essay type questions and the candidate has toanswer any 6 out of them. Each question carries five marks. Part - D consists of 3 essay type questions and the candidate has to answer any 2. Each question carries 10 marks. 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.

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 controller of Examinations.

PRACTICAL RECORD

The entire experiments mentioned in the practical syllabus are xpected 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 underindividual 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

Student has to submit a report of a visit to an environmentally significant site or a wild life sanctuary.

Table 9: Course Structure, workload and Credit Distribution
B.Sc. Programme in Botany -Core

Sem ester	Paper Code	Title of Paper	Hours/ Sem	Hours/ week	Credit
S1	**ABOT1B01T**	Core course I Angiosperm Anatomy	36	2	3
		Core Course I Practical	36	2	
SII	**ABOT2B02T**	Core course II Research Methodology and Microtechnique	36	2	3
		Core course II Practical	36	2	
S III	**ABOT3B03T**	Core Course III Microbiology, Mycology, Lichenology and Plant Pathology	54	3	3
		Core Course III Practical	36	2	
S IV	**ABOT4B04T**	Core Course IV Phycology, Bryology and Pteridology	54	3	3
		Core Course IV Practical	36	2	
	ABOT4B05P	**PRACTICAL PAPER I** Angiosperm Anatomy, Research Methodology ,Microtechnique, Microbiology, Mycology, Lichenolog , Plant Pathology, Phycology, Bryology and Pteridology			4
S V	**ABOT5B06T**	Core Course V Gymnosperms, Paleobotany, Phytogeogreaphy and Evolution	63	3.5	4
		Core Course V Practical	36	2	
	ABOT5B07T	Core Course VI Angiosperm Morphology and Plant Systematics	63	3.5	3
		Core Course VI Practical	36	2	

S V	**ABOT5B08T**	Core Course VII Embryology, palynology, Economic botany, Ethnobotany and Horticulture.	63	3.5	4
		Core Course VII Practical	36	2	
	ABOT5B09T	Core Course VIII General and Bioinformatics, Introductory Biotenchnology, Molecular Biology	63	3.5	4
		Core Course VIII Practical	36	2	
	ABCM5D03T, AECO5D01T, AENG5D01T, ACHE5D02T, AMAT5D02T, APHY5D01T, APSY5D01T, AZOL5D01T, APED5D01T	Offered by other departments	36	2	2
		Project work		1	
S VI	**ABOT6B10T**	Core Course IX Genetics and Plant Breeding	54	3	3
		Core Course IX Practicals	36	2	
	ABOT6B11T	Core Course X Plant Physiology and Metabolism	54	3	3
		Core Course X Practicals	36	2	
	ABOT6B12T	Cell Biology and Biochemistry	54	3	3
		Core Course XI Practicals	36	2	
	ABOT6B13T	Core Course XII Environmental Science	54	3	3
		Core Course XII Practicals	36	2	
	ABOT6E01T	Elective	72	4	3
		Elective Practicals	18	1	
	ABOT6B14P	**Practical Paper II** Gymnosperms, Paleobotany,			4

		Phytogeography, Evolution, Angiosperm Morphology, Plant Systematics, Palynology, Economic Botany, Ethnobotany, Horticulture, Gemneral and Bioinformatics, Introductory Biotechnology and Molecular Biology			
	ABOT6B15P	**Practical Paper III** Genetics, Plant Breeding, Plant Physiology, Metabolism, Cell Biology, Biochemistry, Environmental Science.			4
	ABOT6B16D	Project Work		2	

FIRST SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE 1- ANGIOSPERM ANATOMY

Code: ABOT1B01T

(Total 72 hours: Theory 36, Practical 36)

ANGIOSPERM ANATOMY

Theory-36 Hrs. [2 hours per week]

Module-I

1. Plant Cell Wall
   - A. Cells wall - Fine structure of primary and secondary wall; Cell wall thickening; Pits – simple and bordered; Plasmodesmata - their structure and function.
   - B. Growth of cell wall – Apposition and intussusception
   - C. Extra cell wall materials - lignin, cutin, suberin, callose and wax

   5hrs.
2. Non-living inclusions.
   - A. Reserve food materials-in the examples carbohydrates, proteins, fats& oils Carboihydrates-sugars& starch; Starch grains-structure, examples; Proteins-Aleurone grains; Fats &oils.
   - B. Secretory materials
   - C. Waste materials with examples - Nitrogenous-alkaloids, Non-nitrogenous - gums, resins, tannins, organic acids, essential oils; Mineral crystals-Calcium oxalate, (drusses and raphides), Calcium carbonate – (cystoliths). 3hrs.

Module-II

1. Tissues:- Definition; Types of tissues
   - a. Meristematic tissues - Classification.

i. Theories on apical organization - Apical cell theory, Histogen theory and 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 (a) dicots - common types with three sets of initials (b) monocots - Maize type with four sets of initials.

b. Mature tissues – Definition; Classification – simple, complex and secretory

i. Simple tissues – (a) parenchyma, (b) collenchymas and (c) sclerenchyma, - fibres and sclereids – structure, occurrence and function.

ii. Secretory tissues – (a) glands, (b) glandular hairs,(c) nectaries, (d) hydathodes, (e) schizogenous and lysigenous ducts, (f) resin ducts, (g) laticifers - articulated and non-articulated. 6hrs.

Module-III

1. Vascular bundles - origin and types – (a) conjoint, (b) collateral, (c) bi-collateral, (d) open (e) closed (f) radial (g) concentric - amphicribral and amphivasal. 2hrs.

2. Primary structure of:

(a) Dicot stem - (*Centella, Eupatorium*)

(b) Monocot stem - (*Grass, Bamboo)*

(c) Dicot root - (*Ficus, Tinsopora)*

(d) Monocot root-(*Colocasia, Musa*)

(e) Dicot leaf – (*Ixora)*

(f) Monocot leaf - (*Grass)* (g) Stomata - Dicot and Monocot, Classification (*Metacalfe &Chalk)* 6hrs.

Module-IV

1. Root-stem transition 1hr.

2. Nodal anatomy - unilacunar, trilacunar and multi lacunar types-leaf trace and leaf gaps. 1hr.
3. Normal secondary growth (a) in Dicot stem (*Polyalthia, Vernonia)*; and (b) in 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. Periderm formation and structure - phellogen, phellem, phelloderm, bark, lenticels-structure and function. 7hrs

5. Anomalous secondary growth - General account with special reference to the anomaly in (a) Dicot stem - *Boerhaavia, Bignonia* and (b) Monocot stem- *Dracaena* 3hrs.

PRACTICALS

Practical-36 Hrs. [2hours per week]

Student are expected to

1. Identify at sight the different types of stomata, tissues and vascular bundles.
2. Study the primary structure of stem, root and leaf of Dicots and Monocots (Examples mentioned in the theory syllabus)
3. Study the secondary structure of Dicot stem and root. (Examples mentioned in theory syllabus)
4. Study the anomalous secondary thickening in *Boerhaavia, Bignonia* and *Dracaena*.

Reference

1. Cutter, EG. 1969. Plant Anatomy- Part I Cells & Tissue. Edward Arnold Ltd., London.
2. Cutter, E.G. 1971. Plant Anatomy, Part III Organs Edward Arnold Ltd.,
3. Eames, A.J. & LH Mac Daniels 1987 An Introduction to Plant Anatomy. Tata Mac Grew Hills Publishing Company Ltd. New Delhi.

4. Esau. K. 1985. Plant Anatomy (2nd ed.) Wiley Easter Ltd. New Delhi.
5. Fahn A 2000. Plant Anatomy, Permagon Press.
6. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
7. Tayal M.S Plant Anatomy, Rastogi Publishers, Meerut.
8. Vasishta P.C. 1974. Plant Anatomy, Pradeep Publication, Jalandhar.

SECOND SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE 2: RESEARCH METHODOLOGY AND MICROTECHNIQUE

Code: ABOT2B02T

(Total 72 hours: Theory 36, Practical 36)

RESEARCH METHODOLOGY

Theory-23 Hrs. [1¼ hours per week]

Module-1

1. Introduction to science
2. Steps in scientific methods.
   a) Observation and thoughts
   b) Formulation of a hypothesis
   c) Designing of experiments
   d) Testing of hypothesis
   e) Formulation of theories 2hrs.

Module -II

1. Introduction to Biostatistics: Importance and Limitations of Biostatistics
2. Observations: direct and indirect observations, controlled and uncontrolled observation, 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; biological journals, journal impact factor.
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.

8hrs.

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: Principles, types of centrifuges and their applications.
5. Chromatography - Principle and types: Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Molecular sieving. 7hrs.

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 PowerPoint presentation

Reference: Perspectives of Science

1. Hewitt P.G., Lyons S.A., Suchocki J.A., Yeh J. 2013 Conceptual Integrated Science **,** Pearson Education
2. R.G. Newton- The truth of science, Viva Books, New Delhi, 2nd Edition.

Reference: Biological Techniques

1. Keith Wilson and John Walker (2008). Principles and Techniques of Biochemistry and Molecular Biology 6th edition, Cambridge University Press.
2. Roy, R.N. 1996. A Text book of Biophysics, New Central Book Agency Pvt. Ltd. Calcutta.

Reference: 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 Unv. Press.
4. Prasad, S. 2003. Elements of Biostatistics. Rastogi Publ.
5. Rasogi, V.B. Fundamentals of Biostatistics Ane Book India.
6. Norman T.J. Bailey 2007; Statistical Methods in Biology. Low Priced Edition, Cambridge University Press, Replica Press Private Ltd.

MICROTECHNIQUE

Theory: 13 hrs. (¾ hr. per week)

Module- 1

1. Principles of microscopy-eyepiece lens and objective lenses; Magnification, Resolving power, numerical aperture.
2. Mechanical and optical components of the microscope.
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. 8hrs.

Module-II

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives- Formalin-Acetic-Alcohol (FAA), 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. Sectioning: Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance.
5. Staining: General account, Classification: natural dyes, coal tar dyes. Double staining, Vital staining.
6. Mounting and labeling: Canada Balsam and DPX
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 and 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.

Reference

1. Johansen, D.A. 1940. Plant Microtechnique, McGraw-Hill Book Company, Inc. New York.
2. Kanika, S. 2007. Manual of Microbiology- Tools and Techniques, Ane's Student Edition.
3. Prasad M K and Prasad M K 1975 Outlines of Microtechnique, Emkey Publications

THIRD SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

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

Code: ABOT3B03T

(Total 90 hours: Theory 54, Practical 36)

MICROBIOLOGY

Theory-18 Hrs. [1 hours per week]

Module-1

1. Introduction to Microbiology
2. Bacteria - Classification; based on staining morphology and flagellation; Ultra structure of bacteria; Bacterial growth, Nutrition, Reproduction, Genetic recombination in bacteria, Economic importance of bacteria.
3. - Archaebacteria , Mycoplasma and Actinomycetas
4. Viruses– general characters. Classification, architecture and multiplication. Bacteriophages, TMV, Retroviruses - HIV, Viroids and Prions.
5. Microbial ecology-Rhizosphere and Phyllosphere - Bioremediation.
6. Industrial microbiology - Alcohol, acids, milk products single cell proteins, probiotics.
7. 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

Reference

1. Dubey, R.C. and Maheswari, D.K. 2000. A Text book of Microbiology, Chand & Co, New Delhi.
2. Frazer, W.C. 1998. Food Microbiology, Prentice Hall of India, Pvt.Ltd.

3. Kumar, H.D. and Kumar S. 1998. Modern Concepts of Microbiology Tata Mc Graw Hill, Delhi.
4. Pelzar M.J., Chan E.C.S and. Kreig, N.R. 1986. Microbiology McGraw Hill, New York.
5. Ross, F.C. 1983. Introductory Microbiology, Charles E. Merill Publishing Company.
6. Sharma P.D., 2004. Microbiology and Plant Pathology. Rastogi Publication.

MYCOLOGY (Total: 18hrs.) [1hr.per week]

Module -1

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

PRACTICALS (Total: 9hrs.)

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. John Wiley and Sons, New York.
2. Mehrotra R.S. and Aneja K.R. 1990. An Introduction to Mycology, Wiley, Easter Limited, New Delhi.
3. Kar R K and Misra N M Text Book on Fungi, Kalyani Publishers.
4. John Webster 2007 Introduction to Fungi, Cambridge UniversityPress.
5. Sharma, O. P. 1989 A Textbook of Fungi ,Vikas Publishing House

Lichenology

(Theory: 9 hours) [½ hr. per week]

1. Introduction: Type of Interaction between the components symbiosis-mutatism.
2. Growth forms-Crustose, filamentous, foliose, and fruticose
3. Taxonomy and Classification based on fungal partner
4. Reproduction and Dispersal-Fragmentation, isidia, soredia, cephaloidea, cephala
5. Sexual Reproduction-Typical of fungal partner, producing spores.
6. Economic Uses: Dyes, Cosmetics and perfumes, Medicinal uses, Toxicology, Lichens as food, Bioremediation, Ecological indicators, Lichen in Soil formation and pioneers of Xerosere.

PRACTICALS (Total: 9hrs.)

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

Reference

1. Kershaw, K.A. 1985. Physiological Ecology of Lichen Cambridge University Press.
2. Mamatha Rao, 2009. Microbes and Non-flowering plants - Impact and Applications. Ane Books, New Delhi.

PLANT PATHOLOGY

Theory: 9hrs. [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 measure: Chemical, biological and genetic methods, prophylaxis, 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 (9hrs.)

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.

Reference

1. Agros, G.N. 1997. Plant Pathology (4th ed.), Academic Press.
2. Bilgrami K.H. and H.C. Dube. 1976. A Text Book 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: ABOT4B04T

(Total 90 hours: Theory 54, Practical 36)

PHYCOLOGY

Theory-23Hrs. [1¼ hours per week]

1. Introduction 1 hr
2. Classification of Algae (Fritsch, 1935). 2 hrs
3. General Features: Occurrence, cell morphology, pigmentation, flagellation range of thallus structure, reproduction and life cycles. 2 hrs
4. Chlorophyceae: General characteristics, occurrence, thallus structure, cell structure, flagella, reproduction, interrelationships, Types-*Chlamydomonas*, *Volvox*, *Spirogyra*, *Oedogonium*, *Chara*. 5 hrs
5. Xanthophyceae: General characteristics, occurrence, range of thallus structure, reproduction, interrelationships. Type - *Vaucheria*. 2 hrs
6. Bacillariophyceae: (Diatoms) General characteristics, occurrence, thallus structure, cell structure, cell division, sexual reproduction, auxospores, classification, interrelationships. Type - *Pinnularia*. 2 hrs
7. Phaeophyceae: General characteristics, occurrence, range of thallus structure. anatomy, cell structure, flagella, reproduction, alternation of generations, interrelationships. Types - *Sargassum*. 2 hrs
8. Rhodophyceae: General characteristics, occurrence, range of thallus structure, cell structure, reproduction, life cycle, phylogeny and interrelationships. Type - *Polysiphonia*. 3 hrs
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. 4 hrs

PRACTICALS (Total: 9hrs.)

Identify the vegetative and reproductive structures of the types studied.

Reference

1. Fritsch, F.E. 1935. The Structure and Reproduction of the Algae, Vol. I and II, University Press. Cambridge.
2. Kanika Sharma 2007. Manual of Microbiology - Tools and Techniques 2nd Edition. Ane Books India.
3. Mamatha Rao. 2009. Microbes and Non flowering plants: impact and application. Ane Books Pvt. Ltd., New Delhi.
4. Morris, I. 1967. An Introduction to the Algae, Hutchinson and Co. London.
6. Rober Edward Lee 2008; Phycology: Cambridge University Press India Pvt. Ltd. Ansari Road, New Delhi.

BRYOLOGY

Theory: 9hrs. [½ hr. per week]

Module -1

1. Introduction, general characters and classification by Stotler & (2000, 2008) 1.hrs.
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Development details are not required)
   a. *Riccia* (Marchantiophyta)
   b. *Anthoceros* (Anthocerotophyta)
   c. *Funaria* (Bryophytes) 6 hrs.
3. Evolution of gametophyte and sporophyte among Bryophytes 1hr.
4. Economic importance of Bryophytes ½hr.
5. Fossil Bryophytes ½ hr

PRACTICALS

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

2. Anthoceros - Habit, Anatomy of thallus. V.S. of thallus through antheridium, archegonium and sporophyte.
3. Funaria - Habit, structure of antheridial cluster, archegonial cluster, L.S. of sporophyte.

Reference

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

PTERIDOLOGY

Theory: 22 hrs. [1¼ hrs. per week]

Module-1

1. Introduction, general characters and classification (smith *et al*., 2008- brief outline only) 2hrs.
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Development details are not required)
   a. *Selaginella* (Lycopsida) 3hrs.
   b. *Psilotum* (Psilotopsida) 3hrs.
   c. *Equisetum* (Equisetopsida) 3hrs.

d. *Pteris & Marsilea* (Polypodiopsida) 5hrs.

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: 6hrs.

PRACTICALS

Total: 18 hrs. [1hr. per week]

→ *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

Reference

1. Chandra S. & Srivastava M., 2003., Pteridology in New Millenium, Khuwer Academic Publishers.
2. Eames, A.J. 1979, Morphology of Vascular Plants, lower group. Wiley International edition, New Delhi.
3. Parihar, N.S. 1977, Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
4. Rashid, A. 1976 An introduction of Pteridopyta, Vikas Publishers Co. New Delhi.
6. Smith G.M. 1938 Cryptogamic Botany Vol. II. Bryophytes and Pteridophytes. Mc Graw Hill Book Company, London.
7. Sporne, K.R. 1976, Morphology of Pteridophytes-Hutchi University Library, London.
8. Sreevastava, H.N. A Textbook of Pteridophyta.
9. 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: ABOT5B06T

(Total 99 hours: Theory 63, Practical 36)

GYMNOSPERMS

Theory- 19 Hrs. [1 hour per week]

1. Introduction, General character of Gymnosperms, Classification of Gymnosperms (Sporne, 1965) 3hrs.
2. Distribution, morphology, anatomy, reproduction and life cycle of the following types: a. *Cycas* b. *Pinus* c. *Gentum* 12hrs.
3. Affinities of Gymnosperms with Pteridophytes and Angiosperms 3hrs.
4. Economic importance of Gymnosperms. 1hrs.

PRACTICALS

Total: 18 hrs.

1. *Cycas*-Habit, coralloid root, T.S. of coralloid root, T.S. of leaflet, T.S. of rachis, male cone, microsporophyll, microsporophyll, T.S, of microsporophyll, L.S. of ovule and seed. 6hrs.
2. *Pinus*-branch of unlimited growth, supr shoot, T.S. stem and needle, male cone and female cone, L.S, of male cone and female cone, seed. 6hrs.
3. *Gentum*-Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed. 6hrs.

Reference

1. Chamberlain C.J., 1935, Gymnosperms-Structure and Evolution, CBS Publishers and Distributors, New Delhi.
2. Bhatnmagos. S.P. and Alok Moitra 1996 Gymnosperms. New Age International Pvt. Ltd. New Delhi.
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. 2004 Gymnosperms. S. Chand and Co., Ltd., New Delhi.
6. Biswas C. and Johri B.M. 1997 The Gymnosperms, Narosa Publishing House, 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	1hr.
4.	Fossil Pteridophytes- Rhynia, lepidocarpon and Calamites	3hrs.
5.	Fossil gymnosperms- Williamsonia	½ hrs
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.

PRACTICALS

Total: 9hrs.

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

Reference

1. Andres H.N. 1961, Studies in Paleobotany. John Wiley and Sons Inc., New York.
2. Arnold C.A., 1947, Introduction to paleobotany, Tata Mc Graw Hill, New Delhi.
3. Shukla, A.C. & S.P. Misra, 1975, Essential of Palaeobotany, Vikas Publishing House, Pvt. Ltd., Delhi.
4. Sreevastava H.N., 1998, Palaeootany, Pradeep Publishing Company, Jalandhan.
5. Sewart, W.N., 1983, Palaeobotany and the Evolution of Plants. Cambridge Uni. Press, London.
6. Taylor, T.N. Palebotany- An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.

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

PHYTOGEOGRAPHY

Theory: 15 hrs.

1. Definition, concept, scope and significance of phytogeography. 1hr.
2. Patterns of plant distribution- continuous distribution and discontinuous distribution, vicarism, migration and extinction. 3hrs.
3. Continental drift-Evidences and impact. 2hrs.
4. Glaciation: Causes and consequence 2hrs.
5. Theory of land bridges. 2hrs.
6. Endemic distribution, theories on endemism, age and area hypothesis. 3hrs.
7. Phytogeographical zones (phytochoria) of the world and India 2hrs.

PRACTICALS (9hrs.)

1. Draw the phytogeographic zone of India

Reference

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

EVOLUTION

Total: 20 hrs.

1. Origin of Earth-Introduction; Evidences of organic evolution; Evidences from Morphology, Anatomy, Embryology, Palynonlogy, Genetics and Molecular Biology. 3hrs.
2. Condensation and Plymerisation;Protenoids and Prions-Oparins' concept; Miller's experiment. 3hrs.
3. Evolution of prokaryotic and eukaryotic cells. Archaebacteria- Early fossilized cells. 2hrs.

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. 4hrs.
5. Genetic Constancy and creation of Variability: Cells divisions and genetic constancy;-Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift. 5hrs.
6. Speciation: Isolating mechanism- Modes of speciation-sympatric and allopatric. 3hrs.

Reference

1. Crick F., 1981 Life itself: Its origin and Nature. Simon and Schuster, New York.
2. Theodozius Dobzhansky 1970 Genetics of the Evolutionary Process. Columbia University press.
3. Ledyard Stebbins 1971 the Process of Organic Evolution, prentice Hall.
4. Dott R.H., Batten, 1981 Evolution of the earth 3rd end. McGraw Hill New York.
5. Fox S.W. and K. Dose, 1972 Molecular Evolution and the Origin of Life. W.H. Freeman& Co., San Francisco.
6.. Strickberger, 1990 Evolution, Jones and Bastlett Publishers International, England.
7. Rastogi V B 2014 Organic Evolution. Medtec Publishers.

FIFTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE 6- ANGIOSPERM MORPHOLOGY & SYSTEMATICS

Code: ABOT5B07T

(Total 99 hours: Theory 63, Practical 36)

ANGIOSPERM MORPHOLOGY

Theory-18 Hrs. [1 hours per week]

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

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

b. Stem: Habit-; Modification-Undergound, Aerial, Subaerial with examples. 2hrs.

c. Leaves: Lamina, petiole, , stipule, pulvinus; Phyllotaxy; types-simple and compound; shapes of lamina; leaf margin; leaf surface features: hairiness- tomentose, glabrous, scabrous, strigose, hispid. Types of leaves – simple and compound – palmate and pinnate -, paripinnate and imparpinnate. 3hrs.

d. Flower: Flower as a modified shoot-detailed structure of flowers-floral parts their arrangement, relative position (Hypogyny, Perigyny & Epigyny) 4hrs.

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

III. Fruits-simple, aggregate and multiple with examples; Seed structure- dicot and mono cot- albuminous and exalbuminous, aril, caruncle; 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.

Reference

1. Gangulee, H.C., J.S. Das and C. Dutta. 1982. College Botany (5^{th} Ed.) New Central Book Agency, Calcutta.
2. George, H.M. Lawrence. 1951. Introduction to Plant Taxonomy. MacMillan Com. Ltd., New York.

3. Simpson, M.G. 2006. Plant systematic. Elsevier Academic Press, London

SYSTEMATICS Theory: 45 hrs. [2 ½ hrs. per week]

Module- 1

1. Components of systematics: identification, description nomenclature and classification; objectives and importance of systematics. 2hrs.
2. Development of Plant systematics: Folk taxonomy, Herbalists, Early taxonomists: Caesalpino, Bauhin, Linnaeus; Natural systems; Phylogenetic systems; Phenetics; Cladistics (Brief account of various phases). 3hrs.
3. Systems of classification: Artificial –Linnaeus; Natural – Benthem and Hooker (detailed study); Phylogenetic – Hutchinson; Angiosperm Phylogeny Group system – (introduction only). 4hrs.

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.

   16hrs.

Module –III

1. Taxonomic structure- Hierarchy; Concepts of taxa: Species-Biological, Phenetic and Phylogenetic; Genus; family. 2hrs.
2. Taxonomic character-concept, primitive and advanced character, sources, comparative morphology, vegetative, reproductive, Macro and micro morphology, Interdisciplinary approach in taxonomy: cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy. Importance of phylogenetics.

   3hrs.
3. Contributions of eminent Taxonomists viz Hendrich van Rheed, William Roxburg, Robert White and G.S. Gamble. 2 hrs

Module-IV

1. Plant nomenclature- Limitations of common name, Binomial Nomenclature ICBV/ICN, Principles (introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Rule of Priority-merits and demerits; Effective and valid publication; Author citation. 5hrs.
2. Plant identification- Keys; indented and bracketed, construction and applications. 3hrs.
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 Botanical Garden, Olavanna, Kozhikode. 3hrs.
4. Taxonomic literature- Floras, Monographs, Revisions, Journals and online resources & Databases. 2hrs.

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 5^{th} 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.

Reference

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 Delhi.
14. Pandy, S.N. & S.P. Misra. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.
15. Sharma, O.P. 1996. Plant Taxonomy. TATA Mc Graw Hill, New Delhi.
17. Bharati Bhattacharyaa 2009; Systematic Botany, Narosa Publishing House Pvt. Ltd., New Delhi.

FIFTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE 7- EMBRYOLOGY, PLAYNOLOGY, ECONOMIC BOTONAY, ETHNOBOTANY, HORTICULTURE

Code: ABOT5B08T

(Total 99 hours: Theory 63, Practical 36)

EMBRYOLOGY

Theory-18 Hrs. [1 hours per week]

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

PRACTICAL Total – 9 hours (1 ½ hour per week)

Students should identify-

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

Reference

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. Agarwal S.B. Embryology of Angiosperms- a fundamental approach, Sahithya Bhavan, Hospital Road, Agra.
7. Singh V., P.C. Pande & D.K. Jain 2001; Embryology of Angiosperms- Rastogi Publications, Meerut.

PALYNOLOGY (12hrs.)

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

PRACTICALS (Total-7 hrs.)

1. Study the pollen morphology of Hinbiscus, by acetolytic method.
2. Viability test for pollen
   - in vitro germination using sugar solution (cavity slide method)
   - Terazolium test

References

1. Erdtman G. 1952. Polllen 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, IBH. New Delhi.
5. Shivanna, K.R. & N.S Rangaswami, 1993. Pollen Biollgy, Narosa Publishing House –Delhi.
6. Shivanna & Johri. 1989 The Angiosperms Pollen.John wiley and Sons.

ECONOMIC BOTANY (6hrs.)

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
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, Cinnamon.
15. Medicinal- *Adhatoda, Catharanthus, Phyllanthus, Rauvolfia* 6 hrs

PRACTICALS (Total: 3 hrs.)

1. Students shall be able to identify plants or plant products (raw or processed) studied in the theory and shall be able write Botanical names, Family and morphology of useful parts of source plants.
2. Students should record in a tabular form the details of the items mentioned in the theory syllabus. 3hrs.

ETHNOBOTANY (theory: 6 hrs.)

1. Introduction, scope and significance
2. Major tribes of South India

3. Ethanobotanic significance of the following
   - ❖ *Aegle marmelos*
   - ❖ *Ficus religiosa*
   - ❖ *Curcuma longa*
   - ❖ *Cynadon dactylon*
   - ❖ *Ocimum sanctum*
   - ❖ *Trichopus zeylanica*

PRACTICALS (Total: 3hrs)

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

References

1. Albert F Hill 1959 Economic Botany McGraw-Hill
2. Jain. S.K. 1981. Glimpses of Indian Economic Botany. Oxford
3. Baker. H.G. 1970. Plant and Civilization.
4. Jain. S.K. 1995. A Manual of Ethnobotany. Scientific Publishers, Johhpur.
5. Cotton, C.M. 1996. Ethnobotany- Principles and Applications. Wiley and Sons.
6. Bendre Kumar 2000: Economic Botany' Rastogi Publications, Shivaji road, Meerut.
7. Sambamurthy AVSS and Subramanyan N S 2000 Economic Botany of Crop Plants Asiatech publishers.

HORTICULTURE (Theory: 21 hours (1 ¼ hr. per week)

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

Module-II

1. Seed propagation-seed quality tests, seed treatment, essential condition for successful propagation- raising of seed beds, transplanting techniques. 2 hrs
2. Vegetative propagation:
   a. Cutting (stem, roots and leaf)
   b. Grafting (approach)
   c. Budding (T-budding, patch)
   d. Layering (simple trench, air) 4 hrs

Module-III

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

PRACTICLAS (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

Reference

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. Nayik, 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.

FIFTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

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

Code: ABOT5B09T

(Total 99 hours: Theory 63, Practical 36)

GENERAL INFORMATICS & BIOINFORMATICS

Theory-13 Hrs. [¾ hours per week]

Module-1

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- 2

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 and cyber addiction
4. Health issues: guidelines for proper usage of computers and internet.
5. e-wastes and green computing

Module- 3

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

Reference General Informatics

Anita Goel 2010 Computer Fundamentals, Pearson

Manoj Wadhwa 2012 Fundamentals of Computer

Alan Evans 2011 Informatics –Technology in Action , Pearson

Module- 4

1. Introduction of 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.

Module- 5

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- 6

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. Femiliarizing 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.
2. Attwood, T.K and Arry-smith, D.J. Introduction to Bioinformatics, Pearson.
3. Sundararajan,S. and Balaji, R. Introduction to Bioinformatics, Himalaya Publishing House

MOLECULAR BIOLOGY Theory 23 hrs. [1 ¼ hrs. per week]

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 7hrs.
1. RNA –structure types and properties. 2hrs.
3. Gene action- One gene –one enzyme hypothesis, one cistron one polypetide hypothesis; concept of colinearity; modern concept of gene- cistorns, recons and mutons. 3hrs.
4. Genetic code- Characters of genetic code 2hrs.
5. Central dogma of molecular biopsy protein synthesis; Transcription, post –transcriptional modification of RNA, translation; Teminism. 3hrs.
6. Gene regulation in prokaryotes- operon concept, (Lac operon, trp, operon) 1hr.
7. Gene regulation in eukaryotes (brief account) 2hrs.
8. Mutation-spontaneous and inuced; causes and consequences. Types of mutagens and their effects. Point mutations- Molecular mechanism of mutation- Transition, Transversion and substitution. 3hrs.

Reference

1. Brown T.A. Genomes. John Willey and Sons
2. Benjamin Lewin . Genes. Oxford University Press

INTRODUCTORY BIOTECHNOLOGY

Theory: 27 hours [1 ½ hrs per week]

Module-1

1. The concept of biotechnology, landmarks in the history of botechnology
2. Plant tissue culture- Principles and techniques; Cellular totipotency; in vitor differentiation and re-differentiation.
3. Tissue culture media- Basic components in tissue culture media –Solid and liquid medium; composition and preparation of Murashige and Skoog medium (1962)-.
4. Aseptic techniques *in vitro* culture- sterilization- different methods- sterilization of instruments- and glassware, medium, explants; working principle of laminar air flow clamber and autoclave.
5. *In vitro* culture methods: preparation of explants- surface sterilization, inoculation, incubation, subculturing.
6. Micropropagation- different methods- apical, axillary bud proliferation, direct and indirect organogenesis somatic embryogenesis. 8hrs.

Module- II

1. Methods and Application of tissue culture:
   a. Shoot tip and meristem culture for microprogration
   b. Somatic embryogenesis and synthetic seed production
   c. Embryo culture
   d. Protoplast isolation, culture and regeneration.
   e. Somatic hybridization, cybridization
   f. In vitro secondary metabolite production from cell suspension cultures and immobilized cells.
   g. In vitro production of haploids-anther and pollen culture
   h. In vitro preservation of germplasm 7hrs.

Module – III

a. Recombinant DNA Technology: recombinant DNA construction reassage cloning vectors, plasmids pBR322, bacteriophage based vectors, Ti plasmids. Restriction

endonucleases and ligases transformation and selection of transformatns- using antibiotic resistance markers, Southers 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. 8hrs.

Module-IV

1. Application of Biotechnology in:
   a. Health care- Production of human insulin, human growth hormone
   b. Forensics- DNA finger printing
   c. Horticulture and Floriculture Industry.
   d. Agriculture -Genetically modified crops floaver savr Tomato, Bt crops, Golden Rice.
   e. Virus, Herbicide resistant crops, edible vaccines.
   f. Industry- Production of antibiotics vitamins, amino acids and alcohol

4hrs.

PRACTICALS [Total: 27 hrs.]

1. Preparation of nutrient medium- Murashige and Skoog medium using stock solutions
2. Preparation of explants, surface sterilization, inoculation, incubation, and subculturing of a suitable plant material (eg. carrot)
3. Preparation of synathetic seeds by encapsulation of somatic embyos
4. Demonstration of anther culture
5. Study of genetic engineering tools and techniques using photographs/ diagram (Southern blotting, DNA finger printing, PCR)
7. Extraction of DNA from plant tissue.
8. Visiting a well equipped biotechnology lab nearby (Submit a duly certified detailed record of the same during the practical examiniation)

Reference

1. Brown T A (2006) Gene cloning and DNA analysis; Black well 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 Publishing House, New Delhi.
6. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.
7. Hamond, J., Megary, P *et al.* 2000. Plant Biotechnology. Springer verlag.
8. Ignacimuthus S 1997 Biotechnology, Narosa Publishers New Delhi.
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 J and Bajaj YPS 1977 Plant Cells, Tissue and Organ Culture, Elsevier
13. Sobit RC. & Pachauri SS 2009 Essentials of Biotechnology; Ane books, New Delhi.

FIFTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

OPEN COURSE - APPLIED BOTANY

Code: ABOT5D01T

Total - 36 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 9 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.
3. Chemical fertilizers: types, application, merits and demerits
4. Need of water: Irrigation - Surface, spray, drip irrigation, sprinklers.
5. Plant protection: Biological, Physical and mechanical, Chemical, biopesticide

12 hrs

Module - III BOTANY IN EVERY DAY LIFE

1. Vegetable gardening
2. Mushroom cultivation
3. Vermi composting - technique
4. Biofertilizer Technology
5. Orchid and Anthurium Cultivation
6. Creating Bonsai 10 hrs.

MODULE - IV. ECONOMIC BOTANY

1. General 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, Sunflower
7. Ornamentalants of economic importance - Rose, Jasmine
8. Fruit - Mango, Banana 5 hrs.

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. Naike, 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, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.
15. R.Prakash, Dr.K.Raj Mohan, Jaivakrishi (Organic farming), State Institute of Language, Kerala, Trivandrum.
16. Hudson, T. Hartmann, Dale K.Kester, Fre T. Davies, Robert L. Geneve, Plant Propagation, Principles and Practices.

SIXTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE -9: GENETICS AND PLANT BREEDING

Code: ABOT6B10T

[Total 90 hours: Theory 54, Practical 36]

GENETICS Theory-40 hrs.

Module - 1

1. Introduction - Brief account of Mendel's life history; Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance; Backcross, test cross. 5 hrs.
2. Modified Mendelian ratios:
   a. Alleclic 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 epististic - Comb pattern inheritance in popultry (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, 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, 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; sexchromosomal abnormalities in man. 4 hrs.

3. Sex linked inheritance: Z-linked, Y-linked; Eye color in Drosophila, Heamophilia 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 and record problems related to the theory syllabus
   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 and 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.
4. Lewin B. 2000 Genes VII, Oxford University Press.
5. Rastogi V.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. and Agarwal 1999. Text book of Genetics, S. Chand & Co., New Delhi.

P**LANT BREEDING** Total: 14 hrs. (¾ hr. per week)

Module-I

1. Definition and objectives of Plant breeding - ICAR and its role in plant breeding. 1 hr.
2. Plant Genetic Resources - Components of Plant Genetic Resources. 1 hr.

Module-II

Breeding Techniques -

1. Plant introduction: Procedure, quarantine regulations, acclimatization - major achievements.
2. Selection - mass selection, pureline selection and clonal selection, significance and achievements.
3. Hybridization - procedure; intergeneric, interspecific and intervarietal bybridization.
4. Heterosis breeding - Procedure of heterosis breeding.
5. Mutation breeding - Procedure - achievements.
6. Polyploidy breeding: Procedure, Achievements.
7. Breeding for disease resistance 12 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.

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. and Sunitha Sinha 2000 - Cytogenetics, Plant breeding & Evolution, Vikas Publishing House.
5. Phundan Singh 1996 Essentials of Plant breeding. Kalyani Publishers, New Delhi.

SIXTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE -10: PLANT PHYSIOLOGY AND METABOLISM

Code: ABOT6B11T

[Total 72 hours: Theory 54, Practical 18]

Module-I

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 processes. Mechanism of guard cell movement. K^+ ion mechanism. Purpose of 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-II

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, Lew 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 pholem 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 - Anapleurotic reactions. 1hr.
2. **Enzymes:-** Introduction - Nomenclature of enzymes - Classification of enzymes by IUB - Physico-chemical nature of enzymes - Mechanism of enzyme action - Lowering of energy of activation - Factors affecting enzyme activity:- substrate concentration, pH, Temperature, Redox potential and Enzyme inhibitors. 2 hrs.
3. **Catabolism of carbohydrates:-** Glycolysis:- Two phases of glycolysis - Reactions of glycolysis - Energy balance sheet of glycolysis - Fate of pyruvate under anaerobic and aerobic condition - Citric acid cycle:- Formation of active acetate - Reactions of citric acid cycle - Energy balance sheet of citric acid cycle - Amphibolic nature of citric acid cycle - anapleurotic reactions of citric acid cycle. 3 hrs.
4. **Biosynthesis of Lipids:-** Formation of saturated fatty acids in plants - Synthesis of triglycerides. 3 hrs.

5. **Catabolism of lipids**:- Hydrolysis of lipids - Fate of glycerol - α and β oxidation of fatty acids. 3 hrs.
6. **Catabolism of Proteins**:- Hydrolysis proteins to amino acids - Transformations of amino acid and entry into citric acid cycle.
7. **Electron Transport Chain in Mitochondria**:- Definition of ETC - Redox potential - Electron carriers - Multienzyme complex - Electron transport reactions - Energy transfer sites and synthesis of ATP - Oxidative phosphorylation - Terminal oxidation. 3 hrs.

Practicals 18 hrs.

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

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

References

1. William G. Hopkins, 1999. Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.
2. Lincoln Taiz and Eduardo Zeige 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 distributors.
4. Noggle G.R. and Fritz G. J.1986 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: ABOT6B12T

[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 - Definition - 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. Avinash Upadhyaya & Kakoli Upadhayayo 2005. Basic Molecular Biology. Himalaya Publishers.
2. De Robertis. E.D.P., & De Robertis E.M.S. 1998 Cell and Maolecular Biology Lea & Febiger.
3. Geoffery M. Cooper & Robert E. Haufman. 2007. The Cell - a molecular approach. A.S.S.Press Washington, U.S.A.
4. Gardner, Snustad and Simmons 2006 Principles of Genetics, Wiley.
5. Powar C.B. 1988. Essentials of Cytology, Himalaya Publishing House.
6. Rastogi S.G. Cell Biology. Tata Mc Graw Hill Publishing Company New Delhi.

9.. Rastogi. V.B. 2008. Fundamentals of Molecular Biology, Ane Books India.

BIOCHEMISTRY

Theory [27 Hrs. (1 ½ Hrs.per week)]

1. **Intoduction to Biochemistry:-** Macromolecules, Micromolecules, Metabolic intermediates, Precursor molecules. 3 Hrs.
2. **Carbohydrates:-** Classification of carbohydrates - Structure of monosaccharides (Glyceraldehyde, Erythrose, Ribose, Glucose, Fructose, Galactose and Mannose) - Structure of Disaccharides (Maltose, Isomaltose, Cellobiose, Lactose, Sucrose and Trehalose) - Structure of Oligosaccharides (Raffinose, Gentianose, Stachyose and Verbascose) - Structure of polysaccharides (Starch, Cellulose, Hayluronic acid and Heparin) - Functions of Simple sugars and compound carbohydrates - Carbohydrates - Carbohydrate derivatives (Glycosides, Deoxy sugars and Amino sugars).

   5 Hrs.
3. **Lipids:-** Structure and properties of Glycerol - Classification, structure and properties of fatty acids - classification of lipids by Bloor - Structure of simple lipids (Triglyceride) and Compound lipids (Phosphatidic acid, Lecithin, Cephalin and Sphigomylein) - Brief account on steroids with emphasis on cholesterol.

   5 Hrs.
4. **Amino Acids:-** General structure and properties - Classification based on variable side chain - Structure of protein amino acids - Dipeptide formation - lonization of amino acids - Brief account on non-protein amino acids. 3 Hrs.
5. **Proteins:-** Structure of protein - Primary structure, Secondary structure (α helical & β pleated sheet structure), Tertiary structure and Quaternary structure - Bonds responsible for stability of protein structure - Bonds responsible for stability of protein structure - Denaturation of proteins 5 Hrs.
6. **Nucleotides:-** Chemical composition of nucleotides - Structure of nitrogen bases (Adenine, Guanine, Cytosine, Uracil and Thymine) - Structure of nucleosides - Structure of nucleotides - Functions of nucleotides - Nucleotide derivatives (NAD^+, $NADP^+$, FAD and FMN) 4 Hrs.

7. **Secondary metabolites**:- A brief account of secondary metabolites - Physiological and ecological significance. 2 Hrs.

PRACTICAL 27 Hrs.

1. Schematic qualitative analysis of monosaccharide's, reducing sugars, aldoses, ketoses, starch, proteins and amino acids using suitable biochemical tests.
2. Quantitative estimation of proteins by Biuret test.
3. Quantitative estimation of DNA/RNA
4. Estimation of reducing sugar in germinating seeds.

References:

1. David L; Nelson and Michel M Cox 2000. Lehninger. Principles of Biochemistry. 3rd edition. Macmillan.
2. Geoffrey Zubay 1993 Biochemistry Macemillan Publishing Company, Newyork.
3. David T.Plummer 1971 An Introduction to Practical Biochemistry. Tata Mc Grow Hill.
4. Sadasivam and Manickam 2009 Biochemical methods. New Age International Publishers, New Delhi.
5. Goodwin Y.W., and Mercer E.I. 2003 Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.
6. Donald Voet and Judith Voet. 2004. Biochemistry. 3rd edition. Wiley international edition.
7. Keith Wilson and John Walker 2008. Principles and techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.
8. Trevor Palmer. Enzymes - Biochemistry, Biotechnology and Clinical Chemistry, Norwood Publishing, Chichester.

SIXTH SEMESTER B.Sc. BOTANY DEGREE PROGRAMME

CORE COURSE – 12: ENVRIONMENTAL SCIENCE

Code: ABOT6B13T

[Total 72 hours: Theory 54, Practical 18]

ENVIRONMENTAL SCIENCE Theory-54 Hrs.

Module – I

1. Ecosystem – Definition; abiotic and biotic factors; trophic structure; Food chain an food web; Ecological pyramids; Energy flow; Productivity of ecosystems.
2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous)
3. Plant adaptations: Adaptations in Hydrophytes, Zerophytes, 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 green house 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: 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 Dissolves Oxygen by Winkler's method.
5. Study of morphological and anatomical characteristics of plant groups – Hydrophytes, Zerophytes, halophytes, epiphyte, and parasites.
6. The Students have to visit a site of environemental relevance, wildlife sanctuary/ national park etc. and submit a report at the time of examination.

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.
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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.
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.

SIXTH SEMESTER B.Sc.BOTANY DEGREE PROGRAMME

CORE COURSE – 11: GENETICS AND CROP IMPROVEMENT

Code: ABOT6E01T

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

Module-1.

Crop genetics – General account of original, genetic variability, floral biology, breeding techniques and achievements in 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 – iRII, ICRISAT, CIMMYYT, 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 crops Improvement: a. Plant introduction b. Selection – Principles, Selection of segregating populations, achievements e. 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 prospectus – Significance of halloids and polyploids.
2. Mutations in crop improvement – achievements and future prospects.
3. Genetics of nitrogen fixation – Use of biofertilizers in crop improvement

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 reistance.

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 pathogenecity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance – Oliogogenic, 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 te 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. 200. 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 Wiley & 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	4	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	5	3	6x5 =30
10 marks	2	2	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	3	3	1	1	6x5 =30
10 marks	2	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	Bryology	Pteridology	Total
1 mark	4	2	4	10x1=10
2 marks	4	2	4	10x2=20
5 marks	3	2	3	6x5 =30
10 marks	2	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	Gymno sperms	Palaeo-botany	Phyto geography	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	2	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

MODEL QUESTION PAPER

CORE COURSE – 6

ANGIOSPER MORPHOLOGY AND 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	2	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? 1x10= 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

MODEL QUESTION PAPER

CORE COURSE - 7

EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY AND HORTICULTURE

Model question- Subject wise distribution of marks

Type of questions	Embry-ology	Paly-nology	Horti-culture	Ethno botany	Economic 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	2	6x5=30
10 marks	1	1	1	-	1	2X10=20

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)

MODEL QUESTIONS

CORE 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	2	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	2	2x10=20

MODEL QUESTION PAPER - CORE

COURSE - 9:

GENETICS & PLANT BREEDING

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 F2 ratio ----------
9. The F2 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 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

MODEL QUESTION PAPERS

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	2	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-10: PLANT PHYSIOLOGY AND METABOLISM.

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 β-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 light reaction

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 N2 fixation Explain the different levels of architecture of proteins.

2 x10=20 marks

MODEL QUESTIONS

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	2	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE - 11: CELL BIOLOGY & BIOCHEMISTRY

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.
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

MODEL QUESTION PAPERS

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	1	2x10=20

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE - 12: ENVIRONMENTAL SCIENCE

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 be ----------
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, □ , and □ 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 variou mean o 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

SCHEME OF EXAMINATION

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

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**
(Binomial - 2; family-1) (2x3=6 marks)

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

SCHEME OF EXAMINATION

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

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, Environmental Science, Plant breeding

M- & N Genetics problems

B .Sc. P R O G R A M M E IN B O TA N Y - COMPLEMENTARY

Course structure, Workload and Credit Distribution

Semester	Paper Code	Titele of Paper	Hours / semester	Hours/ week	Credits
S 1	**ABOT1C01 T**	Complementary Course I Angiosperm Anatomy and Microtechnique	**36 hrs**	**2**	**2**
		Complementary Course Practical I	**36 hrs**	**2**	
S II	**ABOT2C02T**	Complementary Course II Cryptogams, gymnosperms and Plant Pathology	**36 hrs**	**2**	**2**
		Complementary Course Practical II	**36 hrs**	**2**	
S III	**ABOT3C03T**	Complementary Course III Morphology, Systematic Botany, Economic Botany, Plant Breeding and Horticutlture	**54 hrs**	**3**	**2**
		Complementary Course Practical III	**36 hrs**	**2**	
S IV	**ABOT4C04T**	Complementary Course IV Plant Physiology, Ecology and Genetics	**54 hrs**	**3**	**2**
		Complementary Course Practical IV	**36 hrs**	**2**	
	ABOT4C05P	External Practical Examinations			**4**

B .Sc. P R O G R A M M E IN B O TA N Y - COMPLEMENTARY
Course Structure, Mark Distribution, Scheme of Examination and Syllabus

Course Code and Title	Instructional Hours		Duration of Exams	Marks				Total
				Theory		Practicals		
	Theory	Prartical		EE	CIE	EE	CIE	
Semester I ABOT1C01T Anatomy and Micro technique	36	36	3 hrs	64	16			80
Semester II ABOT2C02T Cryptogams, Gymnosperms and Plant Pathology	36	36	3 hrs	64	16			80
Semester III ABOT3C03T Morphology, Systematic Botany, Eco. Botany, Plant Breeding & Horticulture	54	36	3 hrs	64	16			80
Semester IV ABOT4C04T Plant Physiology Ecology and Genetics	54	36		64	16			80
Practical Extnl. Exm 50 Record 10 Submission 4			3 hrs			64	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: ABOT1C01T

ANGIOSPERMIC ANATOMY AND MICROTECHNIQUE

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

Module - 1

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

a. Meristemati tissues - Classification - based on origin & position; Organisation of root apex and differentiation of tissue - Histogen theory; Organisation of stem apex and differentiation of tissue - Tunica & Corpus theory.

b. Permanent tissues - Definition - classification; Simple tissues (Parenchyma, collenchyma and Sclerenchyma), Complex tissues (Xylem & Pholem)

Secretory tissues - Glandular tissues (Nectaries in *Euphoribia 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, acitvity 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 (Primary), *Tinospora* - mature (Secondary).

d. Monocot root: *Colocasia*, *Rhoea*

e. Anomlous secondary growth (*Boerhaavia*).

f. Dicot leaf: *Ixora* and Monocot leaf: paddy/grass

MICROTECHNIQUE

(Theory: 9 hours)

Module - 1

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

Module II

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, FG. 1969. Plant Anatomy - Part 1 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.
6. Tayal M.S, Plant Anatomy. Rastogi Publishers, Meerut.

References : Microtechnique

1. Johansen, D.A. 1940. Plant Microtechnique. Mc Graw - Hill Book Company, Inc. New York.
2. Khasim, S.K., 2002. Botanical Micro technique; Principles and Practice, Capital Publishing Company, New Delhi.
3. Toji, T. 2004. Essential of Botanical Microtechnique. Apex Infotec Publ.
4. Prasad M K and Prasad M K. 1975. Outlines of Microtechnique, Emkey Publications

SECOND SEMESTER COMPLEMENTARY BOTANY
CRYPTOGAMS, GYMNOSPERMS & PLANT PATHOLOGY
Course Code: ABOT2C02T

(Total 72 hours: Theory 36, Practical 36)

Cryptogams, Gymnosperms Theory-32 Hrs

. **Module-1**

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

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) 7hrs.
3. Mycology: General characters, Classification (Alexopoulos, 1979). Brief mention only) and evolutionary trends in fungi.
   Importance features of the following divisions:
   a. Mastigomycotina
   b. Ascomycotina.
   c. Basidiomycotina.
4. Structure and life history of Puccinia (development details not required) 4hrs.

Module-III

1. Bryology: General account, morphology and life- history of Riccia 4hrs.
2. Lichenology: General account and economic importance of Lichens with special reference to Usnea. 3hrs.

3. Pteridology: General account, morphology and life history of Selaginella 4hrs.
4. Gymnosperms: General account, economic importance morphology and life history of Cycas (Anatomy not required) 4hrs.

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 3hrs.

PRACTICALS: 32 hours

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 hours

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

Reference: Cryptogams

1. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. I 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 Pancy 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.

Reference: Plant Pathology

1. Agros, G.N 1997. Plant Pathology (4^{th} ed.) Academic Press
2. Bilgrami K.H. & H.C Dube. 1976. A text book of Modern Plant Pathology. International Book Distributing Co. Lucknow
3. Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant Diseases. Chand & Co. Ltd., New Delhi.

THIRD SEMESTER COMPLEMENTARY BOTANY
Course Code : ABOT3C03T
MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND HORTICULTURE
Total : 90 Hours (Theory: 54 hours, Practical : 36 hours)

Morphology Theory : 8 hours

Module -1

1. Leaf - Structure, simple, compound, venation and phyllotaxy.
2. Inflorescence - racemse, cymose and 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 -1

1. Introduction, scope and importance 1 hr.
2. Herbarium techniques: collection, drying, poisoning, mounting & Labeling. Significance of herbaria and botanical gardens; Important herbaria and botanical gardens in India. 4 hrs.
3. Systems of classification - Artificial, Natural and Phylogenetic (Brief account only). Bentham & Hooker's system of classification in detail. 4 hrs.
4. Study the following families: Malvaceae, Rutaceae, fabaceae (with sub-families) Rubiaceae, Apocynaaaceae, Euphorbiceae and poaceae. (16 hrs)

Systematic Botany Practical : 20 hrs.

1. Determine the systematic position of local plants comes under the syllabus base 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 eight 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. Sivaraan, V.V. 1991. Introduction toPrinciples 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 : 6 hrs

Module - 1

1. Brief account on the various categories of plants based on their economic importantance.
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, and Curcuma longifolia.*

Practical : 4 hours

1. Identify at sight the economically important plant produces and products mentioned in the syllabus 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 : 10 hours

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 hours.

1. Demonstration of hybridization technique

References: Plant Breeding

1. Allard. R.W. 1960. Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2. Singhg, 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 hours

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 : ABOT4C04T
Total : 90 Hours (Theory: 54 hours, Practical : 36 hours)
PLANT PHYSIOLOGY
[Theory : 36 hours]

Module -1

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 phosphorylation,
   Dark reactions - Calvin cycle, C_4 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, Photoperiodism and vernalization.
3. Dormancy of seeds - Factors causing dormancy, photoblastin, techniques to break dormancy.
4. 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. Hopkins, (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.

PLANT ECOLOGY [Theory : 9 hours]

Module - 1

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 if succession, Hydrosere Xerosere (with examples.) 3 hours .

Practicals [Total : 9 hrs].

Study the morphological and anatomical adaptations of he 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.

GENETICS Theory: 9 hrs.

1. Introduction and brief history of genetics
2. Mendel's experiments, symbolisation, terminology, heredity and variation;
3. Monohybrid cross, Dihybrid cross, Laws of Mental, test cross and back cross.
4. Modified Mendelian ratios 1) Incomplete dominance in Mirabilis Jalapa
5. Gene interacrtions: Complementary genes - flower colour in *Lathyrus odoratus* (9: 7 ratio), Episatasis - Fruit colour in *Cucurbita pepo* (12:3:1 ratio).

Practical : 9 hours

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. Principle 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. Rastogi V.B 2008, Fundamentals of Molecular Biology, Ane Books, India.

MODEL QUESTIONS

FIRST SEMESTER COMPLEMENTARY BOTANY

ANATOMY & MICROTECHNIQUE

Course Code: ABOT1C01T

Time: 3hrs Maximum 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 ---------- 10 x 1 = 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 adicot stem.

23. Explain the extra stelar secondary growth in stem

24. Give a detailed account of isobilateral leaf with the help of labeled sketch

25. Brifly describe the mechanism of electron microscope

26.I mportant 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: ABOT2C02T

Time: 3 Hours Maximum 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 ---------- (10x1=10 marks)

PART B

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-D

IV 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: ABOT3C03T

Time: 3hrs Max. 64 marks

PART A

I. Answer in one word Answer all questions

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"
5.----------is an example of plant introduction
6. Name a plant breeding station in Kerala
7. Grafting is not possiible in ---------- plants
8. Name the family with inferior ovary
9. Coffee and tea belong to 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. rganization 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: ABOT4C04T

Time: 3 hours Maximum 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 CO2 in C3 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 NADH2 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 anddevelopment.

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. 50 marks

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

Practival 50 marks

Record 10 marks

Submission (Herbarium sheets)… 4 marks

Total 64 marks

SCHEM OF EXAMINATION

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 syllabus

4. D-Specimens from cryptogams included in the syllabus

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, & L Herbarium sheet from students' submission.

10. **M**-Genetics problem