VIMALA COLLEGE (AUTONOMOUS), THRISSUR

B.Sc Programme in

BOTANY

Revised Syllabus (w.e.f 2016 admission)

of CHOICE BASED CREDIT SEMESTER SYSTEM (CBCSS)

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B. Sc Programme in Botany 2016

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AIMS AND OBJECTIVES OF THE PROGRAMME

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

The expected outcome of the syllabus

1. To know the scope and importance of Botany
2. To inculcate interest in nature with its myriad living forms
3. To develop scientific temper among students
5. To undertake scientific projects
6. To give better exposure to the diversity of life forms
7. To give awareness about natural resources and their importance in sustainable development

9. To provide opportunities for the application of the acquired knowledge in day to day life.

10. To develop skill in doing practical experiments, familiarizing equipments and biological specimens.

U.G. PROGRAMME – AN OVERVIEW

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

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

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

Course code: Each course shall have a unique alphanumeric code number, which includes abbreviation of the subject in three letters, the semester number (1 to 6) in which the course is offered, the code of the course (A -Common course, B- Core course, C-Complementary and D- open course to D) and the serial number of the course (01, 02). For example, BOT2B03 represents a Core course of serial

number 03 offered in second semester in B.Sc. Botany Programme. Every under graduate student shall undergo 10 common courses [6 English courses and 4 additional language courses] for completing the programme.

Core courses: These are the courses coming under the main (Core) chosen by the student, offered by the parent department varies from 10 to 18

including a project work. **Complementary courses**: Complementary courses cover one or two disciplines that are related to the core subject and are distributed in the first four semesters. There shall be one **open course** in the fifth semester. Students can opt one open course of their choice offered by any department in the institution other than their parent department.

Each course shall have certain credits. **Credit** is a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course. For passing the degree programme, the students shall required to achieve a minimum of 120 credits of which 38 from common courses; 24 credits from two complementary courses, 2 from open course and 56 from Core courses (including 2 credits for project work).

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

Semester	Common course		Core course	Complementary course		Open	Total
	English	Additional Language		Chem	Zool		
I	4+3	4	3	2	2		18
II	4+3	4	3	2	2		18
III	4	4	3	2	2		15
IV	4	4	3+4*	2+4*	2+4*		27

V VI			4+4+4+3 3+3+3 3+3 +4*+4* +2**			2	17 25
Total	**22**	**16**	**56**	**12**	**12**	**2**	**120**

*Credits of Practical Exam

** Credits of Project Work

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

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

Table-3: SEMESTERWISE DISTRIBUTION OF CREDITS AND MARKS B.Sc.

Botany Programme

Total Credits: 120; Total Marks: 3600

Semester	*Course*		*t Marks*

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

	Total	**15**	**460**

IV Common course: English 4100

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

	Core Course X: Plant Physiology & Metabolism	3	100
	Core Course XI: Cell Biology & Biochemistry	3	100
	Core Course XII: Environmetal Science	3	100
	Core Course XIII: Elective	3	100
	Core Practical – Paper- II	4	100
	Record + Submission [20+10]		30
	Core Practical – Paper- III	4	100
	Record + Submission [20+10]		30

Record of Elective paper 10

Core Course: Project Work	2	50
Total	**25**	**820**

Project work

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

Guidelines for the Evaluation of projects

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

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

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

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

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

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

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

Viva	30	Viva	50

EXAMINATIONS

There shall be university examinations at the end of each semester. **A student shall be permitted to appear for the semester examination, only if he/she secures not less than 75% attendance in each semester.**

Practical examinations shall be conducted by the university at the end of fourth and sixth semester. Project evaluation, viva-voce if any, shall be conducted along with the practical examination towards end of sixth semester.

EVALUATION AND GRADING

Mark system is followed instead of direct grading for each question.

The evaluation scheme for each course shall contain two parts: viz., a. internal evaluation b. external evaluation.

INTERNAL EVALUATION

20% of the total marks in each course are earmarked for internal evaluation. The internal assessment shall be based on a predetermined transparent system involving attendance, written test, assignments and seminars in respect of theory examinations and on test/ records/viva/ attendance in respect of practical courses.

Table-5: Parameters with percentage of marks for Internal Evaluation of Theory and Practical Examination

Parameters		Theory course	Practical course	Marks distribution	
				Theory	Practical
1	Attendance	25%	25%	5	5
2	Test paper I & II (best of two)	50%		10	

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

Table-6 Percentage of Attendance and eligible marks

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

Table-5a: Open Course - Parameters with percentage of marks for Internal Evaluation of Theory Examination

	Parameters	**Theory**	**Marks distribution**
1	Attendance	25%	2.5
2	Test paper I & II (best of two)	50%	5

3	Assignment & Seminar	25%	1 1.5
4	Total	100%	10

Table-5 b Percentage of Attendance and eligible marks for Open Course

% of attendance	% of marks to be awarded	Marks eligible
Above 90%	100	2.5
85-89%	80	2
80-84%	60	1.5
76-79%	40	1
75%	20	0.5

INDIRECT GRADING SYSTEM

An indirect grading system based on a 7-point scale is used to evaluate the performance of students. A student who fails to secure a minimum grade for a pass in a course permitted to write the examination along with the next batch. Each course is evaluated by assigning marks with a letter grade (A+, A, B, C, D, E or F) to that course by the method of indirect grading. An aggregate of E grade with 40 % marks (after external and internal put together) is required in each course for a pass.

Pattern of theory question paper

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set and the question paper setter shall

also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of objective type, short answer type, short essay type/problem solving type and long essay type questions. Different types of questions shall be given different marks to quantify their range.

For all semesters:

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

Table-7 Theory question paper pattern

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

Total	31		80

PRACTICAL EXAMINATION

Practical examination aims to test the candidate's skill in undertaking specific task and do the same in stipulated time in the best possible way rather than their theoretical knowledge. There must be confidentiality in the problems to be asked in the examination. The external evaluation of practical examination shall be conducted by two examiners appointed by the university. Because of the special nature of the practical examination, the board unanimously proposed that both examiners should be external in order to maintain the secrecy and seriousness of the examination.

Practical Record

The entire experiments mentioned in the practical syllabus are expected to be done and recorded. A certified record book is an evidence of the

practical works done by the candidate during the course. Therefore, it must be treated seriously and valued properly. Moreover, the genuine work should be appropriately rewarded. Keeping this in mind the board has decided to

increase the marks of the record work. **The total marks set apart for the record of the programme are 60 i.e., 20 marks for the record of each practical paper.** The criteria to be observed in the valuation of records are fixed and are appended below.

External evaluation of Record - Parameters

a. Content should cover the entire practical works mentioned under individual courses

b. Neatness and scientific accuracy

c. Timely submission

Submissions

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

Practical paper – I

Students are expected to submit any five specimens belonging to Algae, Fungi, Lichen and Pathology or together duly certified by the Head of the department.

Practical Paper – II

Every student has to submit 10 properly identified herbarium sheets together with field book and tour report duly certified by the Head of the department.

Practical Paper –III

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

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

Table-8: Mark distribution of submissions

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

*Evaluation of record of elective paper will be done along with Practical Paper III

Table-1: Course structure, Work load and Credit distribution

B.Sc. PROGRAMME IN BOTANY- Core

Semester	Paper Code	Title of Paper	Instructional hours/ Semester	Hours allotted / Week	Credi
S- I	VBO1B01	CORE COURSE I. ANGIOSPERM ANATOMY	36 hrs	2	3
		CORE COURSE. PRACTICAL –I	36 hrs	2	
S -II	VBO2B02	CORE COURSE II .RESEARCH METHODOLOGY & MICROTECHNIQUE	36 hrs	2	3
		CORE COURSE. PRACTICAL –II	36 hrs	2	
S-III	VBO3B03	CORE COURSE III. Microbiology, Mycology, Lichenology & Plant Pathology	54 hrs	3	3
		CORE COURSE. PRACTICAL –III	36 hrs	2	
S-IV	VBO4B04	CORE COURSE IV Phycology, Bryology & Pteridology	54 hrs	3	3
		CORE COURSE. PRACTICAL –IV	36 hrs	2	
	VBO4BPL1	**PRACTICAL PAPER – I** Angiosperm Anatomy, Research Methodology, Microtechnique Microbiology, Mycology, Lichenology, Plant Pathology, Phycology, Bryology & Pteridology			4
S-V	VBO5B05	CORE COURSE V GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY & EVOLUTION	63 hrs	3.5	3
		CORE COURSE. PRACTICAL –V	36 hrs	2	

	VBO5B06	CORE COURSE VI Angiosperm Morphology & Plant Systematics	72 hrs	4	4
		CORE COURSE. PRACTICAL –VI	36 hrs	2	
	VBO5B07	CORE COURSE VII Embryology, palynology, economic	63 hrs	3.5	4

		Botany, ethanobotany & Horticulture			
		CORE COURSE. PRACTICAL VII	36 hrs	2	
	VBO5B08	CORE COURSE. - VIII General & bioinformatics, Introductory biotechnology, Molecular biology	72 hrs	4	4
		CORE COURSE. PRACTICAL –VIII	36 hrs	2	
	VBO5D01	OPEN COURSE Plant Tissue Culture	36 hrs	2	2
	VBO5D02	OPEN COURSE APPLIED BOTANY	36 hrs		
	VBO5D03	OPEN COURSE GENERAL BOTANY	36 hrs		
S – VI	VBO6B09	CORE COURSE IX Genetics & Plant Breeding	54hrs	3	3
		CORE COURSE. PRACTICAL IX	36 hrs	2	
	VBO6B10	CORE COURSE - X Plant Physiology & Metabolism	54hrs	3	3
		CORE COURSE. PRACTICAL – X	36 hrs	2	
	VBO6B11	CORE COURSE -XI Cell Biology & Biochemistry	54hrs	3	3

		CORE COURSE. PRACTICAL - XI	36 hrs	2	
	VBO6B12	CORE COURSE – XII Environmental Science	54 hrs	3	3
		CORE COURSE PRACTICAL – XII	36 hrs	2	
	VBO6E01	ELECTIVE GENETIC ENGINEERING	54 hrs	3	3
		ELECTIVE -. PRACTICAL	18 hrs	1	
	VBO6E02	ELECTIVE -GENETICS AND CROP IMPROVEMENT	54 hrs	3	
		ELECTIVE -. PRACTICAL	18 hrs	1	
	VBO6E03	ELECTIVE –ADVANCED PLANT SYSTEMATICS	54 hrs	3	
		ELECTIVE -. PRACTICAL	18 hrs	1	
		PROJECT WORK		1	2

	VBO6BPL2	**PRACTICAL PAPER- II** Gymnosperms, palaeobotany, Phytogeography, evolution Angiosperm morphology, plant Systematics, embryology, Palynology, economic Botany, ethanobotany, Horticulture, general & Bioinformatics, Introductory biotechnology & Molecular biology			4
	VBO6BPL3	**PRACTICAL PAPER- III** Genetics, plant breeding Plant physiology, metabolism Cell biology, biochemistry & Environmental science			4
	VBO6BPRV	PROJECT WORK		1	2

Table-9: Course structure and mark distribution

B.Sc. PROGRAMME IN BOTANY
Core Course - Botany
Course Structure, instructional hours, Mark Distribution
and Scheme of Examination

Course Code	Instructional Hours		Duration of Exams	Marks				Total
	Theory	Practical		Theory		Practical		
				EE*	IE**	EE	IE	
VBO1B01	36	36	3 hrs	80	20	--	--	100
VBO2B02	36	36	3 hrs	80	20	--	--	100
VBO3B03	54	36	3hrs	80	20	--	--	100
VBO4B04	54	36	3hrs	80	20	--	--	100
VBO4BPL1 Core Pract. PL- I Record Submission			3 hrs			80 20 10	20	100 20 10
VBO5B05	63	36	3 hrs	80	20	--	--	100
VBO5B06	72	36	3 hrs	80	20	--	--	100
VBO5B07	63	36	3hrs	80	20	--	--	100
VBO5B08	72	36	3hrs	80	20	--	--	100
VBO5D01	36	---	2 hrs	40	10	--	--	50
VBO6B09	54	36	3 hrs	80	20	--	--	100
VBO6B10	54	36	3hrs	80	20	--	--	100
VBO6B11	54	36	3hrs	80	20	--	--	100
VBO6B12	54	36	3hrs	80	20	--	--	100
VBO6E01	90		3hrs	80	20	--	--	100

VBO6BPL2 Core Pract. PL-II Record Submission			3 hrs			80 20 10	20	100 20 10

VBO6BPL3
Core Pract. 3hrs 80 20 100 PL-III Record 20 20 Submission 10 10

Record of Elective Paper						10		10
VBO6BPRV Project work PR						40	10	50
Total				**1080**	**270**	**380**	**70**	**1800**

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

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

Code: VBO1B01

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

ANGIOSPERM ANATOMY

Theory –36 Hrs. [2 hours per week]

Module - I

1. Plant Cell- General Structure of a plant cell (Brief only).

A. Cell wall – fine structure of primary and secondary wall; cell wall thickening; Pits - simple, bordered; Plasmodesmata-their structure and function.

B. Growth of cell wall - Apposition, Intussusception

C. Extra cell wall materials - lignin, cutin, suberin, callose, wax. D. Cell wall properties. 5 hrs. 2. Non-living inclusions

a. Reserve food materials - carbohydrates, proteins, fats & oils Carbohydrates - sugars & starch; Starch grains -structure, types with examples; Proteins - Aleurone grains with examples; Fats & oils examples.

b. Secretory materials

c. Waste materials - Nitrogenous – alkaloids, Non-nitrogenous- gums, resins, tannins, organic acids, essential oils; Mineral crystals - Calcium oxalate, Drusses, Raphides, Calcium carbonate – cystoliths with examples 3 hrs.

Module-II

1. Tissues :- Definition -Types

a. Meristematic tissues - classification.

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

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

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

2 hrs.

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

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

ii. Complex tissues – Definition- Xylem and Phloem Structure, function iii. Secretory tissues - glands, glandular hairs, nectaries, hydathodes, schizogenous and lysigenous ducts, resin ducts, Laticifers –articulated and non-articulated

6 hrs.

Module - III

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

2 hrs.

2. Primary structure of:

Dicot root – Vigna, Limnanthemum

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

Monocot root – (*Colocasia*, *Musa*)

Monocot stem - (Grass/bamboo, *Asparagus*)

Dicot leaf - (*Ixora*)

Monocot leaf - (Grass)

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

1. Root - stem transition 1 hr.

2. Normal secondary growth in Dicot stem & (Eupatorium, Vernonia); Dicot root (Tinospora, Ficus); Formation of vascular cambial ring - structure and activity of cambium – storied and non-storied, fusiform and ray initials; Formation of secondary wood, specondary phloem, vascular rays, growth ring, heart wood, sapwood. Extra stelar Secondary thickening in stem and root - Periderm formation. Structure - phellogen, phellem, phelloderm, bark, lenticels - structure & function. 8hrs

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

3 hrs.

PRACTICALS

Practical –36 Hrs. [2 hours per week]

Students are expected to

1. Identify at sight dicot and monocot stomata, parenchyma, collenchyma, sclerenchyma, xylem, phloem, and vascular bundles.
2. Study the primary structure of stem, root and leaf of Dicots and Monocots (Examples mentioned in the theory syllabus)
3. Study the secondary structure of Dicot stem and root. (Examples mentioned in theory syllabus)
4. Study the anomalous secondary thickening in *Boerhaavia, Bignonia* and *Draceana*

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SECOND SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE- 2: RESEARCH METHODOLOGY AND MICROTECHNIQUE

Code: VBO2B02

[Total 72 hours; Theory 36, Practical 36]

RESEARCH METHODOLOGY

Theory: 23 hrs. (1 ¼ hours per week)

Module – I

1. Introduction to science –Definition, Science and not Science, Meaning, Objectives, Types and Significance of Research
2. Steps in scientific methods
   -Observation
   - Hypothesis , Types
   - Kinds of experiments
   - Replication, Repeatbility, Error
   - Interpretation- Induction, Deducio
   - Documentation
   - Record Keeping
   - Research Report Writing
   - Journals
   - Presentation

3 hrs. **Module II**

1. Introduction to Biostatistics: Importance and limitations of Biostatistics 2. Data collection: Introduction; Sampling; random and non random. 3. Representation of data; Tables, Bar diagram, Pie diagram, Histogram, Frequency polygon, Ogive, Frequency curve [both manual and using computer].
4. Measures of central tendency: mean, median and mode
5. Measures of dispersion: Range, Mean Deviation, Variance, Standard Deviation, Coefficient of variation.
6. Correlation and regression (brief account).
7. Probability-Laws of probability: Addition theorem and Multiplication theorem.
8. Probability Distribution: Binomial Distribution, Normal Distribution and Poisson Distribution.
9. Test of hypothesis : Null hypothesis, Alternate hypothesis Chi-square test and t-test
10. Design of experiments: Latin square, randomized Block design, factorial.

12hrs

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Module III

1. Solutions: representing concentrations: Molarity, Normality, Percentage and ppm.
2. Acids and bases, buffers and pH, measurement of pH. preparation and use of buffers in biological studies.

3. Photometry: Colorimetry and Spectrophotometry, principle, working and uses.

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

8 hrs.

PRACTICALS [Total: 24 hrs]

1. Preparation of solutions of known concentrations using pure samples and stock solutions
2. Preparation of buffers
3. Demonstration of Measurement of pH using pH meter.
4. Work out the problems related to mean, median, mode, standard deviation, and probability.
5. Familiarize the technique of data representation (bar diagram, histogram, pie-diagram and frequency curve (both manual and using computer).
6. Preparation of OHP and LCD presentations

References: Perspectives of Science

1. Kothari C R- Research Methodology, Techniques and methods 2. P.G. Hewitt, J.A. Suchocki ISBN-10 0805 390385, Conceptual integrated science ISBN-139780805390384.

3. R.G. Newton – The truth of science, Viva Books, New Delhi, II Edition.

References: Biological techniques

1. Keith Wilson and John Walker (2008). Principles and techniques of Biochemistry and Molecular Biology 6th edition. Cambridge University Press. 2. Hoppe, W. (edt). 1983. Biophysics. Springer Verlag.

3. Rogers, A.W. 1969. Techniques of Autoradiography. Elsevier Publishing Company.

4. Roy, R.N. 1996. A Text book of Biophysics. New Central Book Agency Pvt. Ltd., Calcutta.

5. Sasidharan, A. 1984. Selected Topics of Biophysics. Frontier Area Publishers. 6. Slayter. E.M. 1970. Optical methods in Biology. Wiley Intersciences. 7. Wong. C.H. 1965. Radiation Tracer Methodology in Biophysical Sciences. Prentice Hall.

References: Biostatistics

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

MICROTECHNIQUE

Theory: 13 hrs. (3/4 hr. per week)

Module - I

1. Microscopy – Microscope and its Components
2. Types of microscopes: Light microscope, Compound microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope: Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM)
3. Micrometry – Stage micrometer, Ocular micrometer, Calibration and working.
4. Photomicrography -digital camera, Camera Lucida (Principle) 7 hrs.

Module - II

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives – Formalin – Acetic – Alcohol, Carnoy's fluids I & II, Chromic

acid – Acetic acid – Formation (CRAF)

2. Dehydration and infiltration – general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series.
3. Infiltration – paraffin wax method, Embedding.
4. Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance.
5. Staining – General account, Classification: natural dyes, coaltar dyes. Double staining, Vital staining
6. Mounting.
7. A brief account on whole mounting, maceration and smears

6 hrs.

PRACTICALS

Total: **12 hrs.**

1. Parts of microscope and its operation.
2. Free hand sectioning of stem, leaves, Staining and mounting.
3. Measurement of pollen size using micrometer.
4. Demonstration of dehydration, infiltration, embedding and microtoming.

References

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

THIRD SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

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

Code: VBO3B03

[Total 90 hours: Theory 54, Practical 36]

MICROBIOLOGY Theory- 18 hrs. [1 hr. per week]

Module - I

1. Introduction to Microbiology
2. Bacteria – Brief introduction on Bergey's classification; Ultra structure of bacteria; Bacterial growth, Nutrition, Reproduction, Genetic recombination in bacteria, Economic importance of bacteria
3. Viruses – Classification, architecture and multiplication, Bacteriophages, TMV, retroviruses- HIV, Viriods, Prions.
4. Microbial ecology – Rhizosphere and Phyllosphere. (Brief only) 5.

Industrial microbiology –alcohol, acids, milk products single cell proteins

6. Bacterial pure culture techniques – streak plate method, Spread plate method, pour plate method.

PRACTICALS (Total: 9 Hrs.)

1. Simple staining
2. Gram's staining – Curd
3. Demonstration of Gram's staining in root nodules
4. Demonstration of culture and isolation of bacteria using nutrient agar medium(PDA)

References

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

Hans g Schlegel21012; General Microbiology- Cambridge University Press Low

Priced Indian Edition, , Replica Press Pvt. Ltd.

MYCOLOGY (Total; 27 hrs.) [1 1/2 hr. per week]

Module - I

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

7. Deuteromycotina: General characteristics, occurrence reproduction and life cycle- Type: Cercospora.

8. Economic importance of fungi: Medicinal, industrial, Agricultural, Food, Genetic Studies and fungal toxins.

LICHENOLOGY

9. Introduction to lichenology: symbiosis – mutualism, Different growth forms – Crustose (Paint like), filamentous (hair-like), foliose (leafy), and fruticose (branched) , Ascolichen, Basidiolichen

10. Ascolichen – Usnea : asexual and sexual reproduction

11. Economic importance of lichens.

PRACTICALS (Total: 18 hrs.)

1. Slides of Pythium, Albugo, Mucor, Agaricus, Peziza
2. Micropreparation- Puccinia , Cercospora
3. Identification of types of Lichen

References

1. Alexopoulos C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology, 4th Edn. JohnWiley and Sons, New York.

2. Alexopoulos, C.J. and Mims C.W. 1979. Introductory Mycology, 3rd Edition, John Wiley and Sons, New York.

3. Mehrotra R.S. and Aneja K.R. 1990. An Introduction to Mycology, Wiley, Eastern Limited, New Delhi..

4. Gilbert, O. 2004. Lichen Hunters. The Book Guild Ltd. England

5. Kershaw, K.A. 1985. Physiological Ecology of Lichen Cambridge University Press.

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.

http://www.lichen.com

http://www.newscientistspace.com

PLANT PATHOLOGY

Theory: 9 hrs. [½ hr. per week]

1. Introduction – Concepts of plant disease, pathogen, causative agents, symptoms
2. Mechanism of disease resistance (morphological, physiological anatomical, biochemical and genetic), Physiology of parasitism (fungal toxin).
3. Symptoms of diseases: spots, blights, wilts, rots, galls, canker, gummosis, necrosis, chlorosis, smut, rust, damping off.
4. Control measures: Chemical, biological and genetic methods, quarantine measures.
5. Brief study of Plant diseases in South India (Name of disease, pathogen, symptom and control measures need to be studied.)

1.Citrus Canker 2. Mahali disease of Arecanut, 3. Blast of Paddy, 4. Quick wilt of pepper, 5. Mosaic disease of Tapioca, 6. Bunchy top of Banana. 7. Root wilt of coconut.

PRACTICALS (9 hrs.)

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

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

Submission

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

References

1. Agros, G.N. 1997. Plant Pathology (4^{th} ed) Academic Press. 2. Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.

3. 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: VBO4B04

[Total 90 hours: Theory 54, Practical 36]

PHYCOLOGY Theory-23 hrs [1 ¼ hrs. per week]

1. Introduction
2. Classification of Algae. Fritsch (1935).
3. General Features: Occurrence, cell morphology, range of thallus structure, reproduction and life cycles.
4. Chlorophyceae: General characteristics, occurrence, thallus structure, cell structure, flagella, reproduction, interrelationships. Types -Chlamydomonas, Volvox, Spirogyra, Oedogonium, Chara.
5. Xanthophyceae: General characteristics, occurrence, range of thallus structure, reproduction, interrelationships. Type- Vaucheria.
6. Bacillariophyceae: (Diatoms) General characteristics, occurrence, thallus structure, cell structure, cell division, sexual reproduction, auxospores, classification, interrelationships. Type -Pinnularia.

7. Phaeophyceae: General characteristics, occurrence, range of thallus structure, anatomy, cell structure, flagella, reproduction, alternation of generations, interrelationships. Type - Sargassum.
8. Rhodophyceae: General characteristics, occurrence, range of thallus structure, cell structure, reproduction, life cycle, phylogeny and interrelationships. Type Polysiphonia.
9. Economic Importance: Algae as food, fodder, green manure, bio-fuels, pollution indicators, research tools, medicinal uses of algae, Commercial Products – carrageenin, agar-agar, alginates, diatomaceous earth. Harmful effects – Water bloom, eutrophication, neurotoxins, parasitic algae.

PRACTICALS (Total: 9 hrs.)

Identify the vegetative and reproductive structures of the types studied.

1. Familiarizing the technique of algal herbarium sheets.

References

1. Anand, N. 1989. Culturing and cultivation of BGA. Handbook of Blue Green Algae Bishen Sing Mahendra Pal Sing.
2. Fritsch, F.E. 1935. The structure and reproduction of the algae. Vol. 1 and II, Uni. Press. Cambridge.
3. Kanika Sharma 2007. Manual of Microbiology. Tools and Techniques 2nd Edition. Ane Books India. (pp. 376-377. Composition of media used for algal culture.
4. Mamatha Rao. 2009. Microbes and Non flowering plants: impact and application. Ane Books Pvt. Ltd., New Delhi.
5. Morris, I. 1967. An Introduction to the algae. Hutchinson and Co. London.
6. Papenfuss, G.F. 1955. Classification of Algae.
7. Rober Edward Lee 2008; Phycology:Cambridge University Press india Pvt. Ltd. Ansari Road, New Delhi
8. Van Den Hoek, D.G. Mann and H.M. JaHns 2009: Cambridge University Press India Pvt. Ltd. Ansari Road, New Delhi.

BRYOLOGY Theory-9 hrs [1/2 hr. per week]

Module - I

1. Introduction, general characters and classification by Stotler & Stotler (2000, 2008)

1.hr.

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

b. Anthoceros (Anthocerotophyta)

c. Funaria (Bryophyta) 6 hrs.

3.Evolution of gametophyte and sporophyte among Bryophytes 1 hr.

4.Economic importance of Bryophytes 1/2 hr.

5.Fossil Bryophytes 1/2 hr. **PRACTICALS**

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

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

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

References

1. Campbell H.D, 1940, The Evolution of land plants (Embryophyta), Univ. Press, Stanford.

2. Chopra R.N. and P.K. Kumar, 1988, Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.

3. Crandall-Stotler, B. and R. E. Stotler. 2000. In A. J. Shaw and B. Goffinet, Bryophyte Biology, Cambridge University Press.

4. Crandall-Stotler, B. and R. E. Stotler. 2008. In A. J. Shaw and B. Goffinet, Bryophyte Biology, Cambridge University Press (Revised edition)

5. Gangulee Das and Dutta., College Botany Vol.1, Central Book Dept. Calcutta. 6.

Parihar, N.S. An Introduction to Bryophyta Central Book Depot, Allhabad, 1965. 7.

Shaw.J.A. and Goffinet B., 2000, Bryophyte Biology, Cambridge University Press.

8. Smith G.M. 1938, Crytogramic Botany Vol.II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.

9. Sporne K.R.,1967, The Morphology of Bryophytes. Hutchinson University Library, London.

10. Vasishta B.R. Bryophyta. S. Chand and Co. New Delhi.

11. Watson E.V. 1971, The structure and life of Bryophytes. Hutchinson University

Library, London.

12. Gangulee, H.C. and Kar A.K. College Botany Vol.II, New Central Book Agency, Calcutta.

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

Module- I

1. Introduction, general characters and classification (Smith et al., 2008 – brief outline only) 2 hrs. 2. Study the distribution, morphology, anatomy, reproduction, life cycle and

affinities of the following types (Developmental details are not required) a. *Selaginella* (Lycopsida) 2 hrs. b. Psilotum (Psilotopsida) 2 hrs. .*c. Equisetum* (Equisetopsida) 2 hrs. d. *Pteris* & *Marsilea* (Polypodiopsida) 4 hrs.

3. Apogamy and apospory in Pteridophytes; Stelar evolution in Pteridophytes; Heterospory and seed habit; Affinities of Pteridophytes; Economic importance of Pteridophytes with special reference to biofertilizers: Contribution of Indian Pteridologists 10 hrs.

PRACTICALS

Total: 18 hrs. [1 hr. perweek]

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

Strobilus *Psilotum*- habit, T.S. of stem, C.S. of synangium (Slides

only)

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

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

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

References

1. Bower, F.O. 1935, Primitive Land Plants – Cambridge, London.

2. Chandra S. & Srivastava M., 2003, Pteridology in New Millenium, Khuwer Academic Publishers.
3. Eames, A.J. 1979, Morphology of Vascular Plants, lower group. Wiley International edition, New Delhi.
4. Parihar, N.S. 1977, Biology and Morphology of Pteridophytes, Central Book Depot, Allhabad.
5. Rashid, A. 1976, An Introduction to Pteridopyta, Vikas publ. Co. New Delhi.
6. Ranker, T.A. & Haufler, C.H. (eds.), 2008. *Biology and Evolution of Ferns and Lycophytes*. Cambridege University Press.
7. Mehltreter, K., Walker, L.R. & Sharpe, J.M. (eds.) 2010. *Fern Ecology*. Cambridge University Press.
8. Smith, A.R., Pryer, K.M., Schuttpelz, E. Korall, P., Schnelder, H. and Wolf., P.G. 2006. A Classification for extant ferns. *Taxon* 53: 705-731.
9. Smith, A.R., Pryer, K.M., Schuettpelz, E. 2008. Fern classification. *In*: T.A. Ranker and C.H. Haufler (eds.). *Biology and Evolution of Ferns and Lycophytes*. Cambridge University press, U.K. pp. 45-67.
10. Smith G.M. 1938, Cryptogamic Botany Vol. .II. Bryophytes and Pteridophytes. McGraw Hill Book Company, London.
11. Sporne, K.R. 1967, Morphology of Pteridophytes – Hutchi University Library, London.
12. Sreevastava, H.N. A text book of Pteridophyta.
13. Vasishta B.R. 1993, Pteridophyta – S. Chand and Co., New Delhi.

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

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

Code: VBO5B05

[Total 99 hours: Theory 63, Practical 36]

GYMNOSPERMS

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

1. Introduction, General characters and classification of Gymnosperms (Sporne, 1965) 3 hrs.

2. Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): a. *Cycas* b. *Pinus* c. *Gnetum* 12 hrs.

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

4. Economic importance of Gymnosperms. 1 hr. **PRACTICALS** Total: 18 hrs.

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

References

1. Chamberlain C.J., 1935,Gymnosperms – Structure and Evolution, Chicago University Press.

2. Coutler J.M. and C.J. Chamberlain, 1958, Morphology of Gymnosperms. Central Book Depot. Allahabd.

3. Sporne K.R. 1967, The Morphology of Gymnosperms, Hutchinson and Co. Ltd.

London.

4. Sreevastava H.N. 1980, A Text Book of Gymnosperms. S. Chand and Co. Ltd., New

Delhi.

5. Vasishta P.C. 1980, Gymnosperms. S. Chand and Co., Ltd., New Delhi.

PALAEOBOTANY [Total: 9 hrs.]

1. Introduction and objectives 1 hr. 2. Fossil formation and types of fossils 1 hr. 3. Geological time scale- sequence of plants in geological time 1 hr. 4. Fossil Pteridophytes-Rhynia, lepidocarpon and Calamites 3 hrs.

5. Fossil gymnosperms- Williamsonia ½hr. 6. Importance of Indian Paleobotanical Institutes (brief) 1hr. 7. Brief mention of fossil deposits in India ½ hr. 8. Indian Palaeobotanists: Birbal Sahni and Savithri Sahni ½ hr. 9. Applied aspects of Palaeobotany- exploration of fossil fuels ½ hr.

PRACTICALS Total: 9hrs

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

References:

1. Andrews H.N. 1961, Studies in Paleobotany. John Wiley and Sons Inc., New York.
2. Arnold C.A., 1947, Introduction to paleobotany, Tata McGraw Hill, New Delhi. Shukla, A.C. & S.P. Misra, 1975, Essential of Palaeobotany, Vikas Publishing House, Pvt. Ltd., Delhi.
3. Sreevastava H.N., 1998, Palaeootany, Pradeep Publishing Company, Jalandhan. Sewart, W.N., 1983, Palaeobotany and the Evolution of Plants. Cambridge Uni.

Press, London.

4. Taylor, T.N. Paleobotany. An Introduction to Fossil Plant Biology. Mc Graw Hill, New York.
5. Steward A.C.,1935, Fosil Plants Vol. I to IV.
6. Watson J. An introduction to study of fossil plants. Adams and Charles Black Ltd. London.

PHYTOGEOGRAPHY [Theory: 15 hrs]

1. Definition, concept, scope and significance of phytogeography. 1 hr.

2. Patterns of plant distribution - continuous distribution and discontinuous distribution, vicarism, migration and extinction 3 hrs.

3. Continental drift -Evidences and impact. 2 hrs. 4. Glaciation: Causes and consequences. 2 hrs. 5. Theory of land bridges. 2 hrs. 6. Endemic distribution, theories on endemism, age and area hypothesis3 Hrs.

7. Phytogeographical zones of India. 2 hrs.

PRACTICALS (9 hrs.)

1. Draw the phytogeographic zones of India only

References

1. Ronald Good, 1947. The Geography of Flowering Plants. Longmans, Green and Co, New York

2. Armen Takhtajan, 1986. Floristic Regions of the World. (translated by T.J. Crovello & A. Cronquist). University of California Press, Berkeley.

3. P. D. Sharma, 2009, Ecology and Environment, Rastogi Publications,Meerut

EVOLUTION [Total: 20 hrs.]

1. Origin of Earth – Introduction; Evidences of organic evolution; Evidences from Morphology, Anatomy, Embryology, Palynology, Genetics and Molecular

Biology. 3 hrs. 2. Condensation and Polymerisation; Protenoids and Prions – Oparin's concept; Miller's experiment. 3 hrs.

3. Evolution of prokaryotic and eukaryotic cells. Archaebacteria – Early fossilized cells. 2 hrs. 4. Theories on origin and evolution of species: Spontaneous generation; Lamarckism;

Darwinism; Weismann and de Vries, Neo-Darwinism and its

+

objection; Arguments and support for Darwinism. 4 hrs.

5. Genetic Constancy and Creation of Variability : Cell divisions and genetic

constancy; – Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift. 5 hrs. Speciation: Isolating mechanism – Modes of speciation – sympatric and allopatric. 3 hrs.

References

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

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-6: ANGIOSPERM MORPHOLOGY& SYSTEMATICS Code: VBO5B06

[Total 108 hours: Theory 72, Practical 36]

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

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

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

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

c. Leaves: Lamina, petiole, leaf tip, leaf base, stipule, pulvinus; Phyllotaxy; types - simple and compound; shapes of lamina; leaf tip; leaf base; leaf margin; leaf surface features: hairiness - tomentose, glabrous,

scabrous,

strigose, hispid. 3 hrs. II. Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium,

coenanthium verticillaster, thyrsus) 3 hrs.

III. Flower: Flower as a modified shoot - detailed structure of flowers - floral parts - their arrangement, relative position, cohesion and adhesion - symmetry of flowers - floral diagram and floral formulae. 4 hrs.

IV. Fruits – simple, aggregate and multiple with examples; Seed structure - dicot and monocot - albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations. 4 hrs.

PRACTICALS (Total: 9 hours)

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

References

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

SYSTEMATICS Theory: 45 hrs. [3 hrs. per week]

Module-I

1. Components of systematics: identification, description nomenclature and classification; objectives and importance of systematics 2 hrs.

2. Development of Plant systematics: Folk taxonomy, Herbalists, Early taxonomists: Caesalpino, Bauhin, Linnaeus; Natural systems; Phylogenetic 2 hrs. systems;Phenetics; Cladistics (Brief account of various phases).

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

Module - II

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

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

25 hrs.

Module- III

1. Taxonomic structure – Hierarchy; Concepts of taxa: Species – Biological, Phenetic and Phylogenetic; Genus; Family. 2 hrs.

2. Taxonomic character – concept, primitive and advanced characters, sources, comparative morphology, vegetative, reproductive, Macro and micromorphology, modern trends in taxonomy, cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy and phylogenetics. 3 hrs.

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

1. Plant nomenclature – Limitations of common name, ICBN, Principles(introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Priority – merits and demerits; Effective and valid publication; Author citation. 5 hrs.

2. Plant identification – Keys; indented and bracketed, construction and applications. 3 hrs. 3. Taxonomic information resources – Herbarium preparation and maintenance, Herbarium types: International- Kew (K); National-Central national herbarium (CAL), MH Coimbatore. Botanic Gardens: RBG, Kew, IGB, Kolkotta; TBGRI and Malabar botanicl Garden, Olavanna , Kozhikode.

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

PRACTICALS Total: 27 hrs.

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

1. Students shall be able to prepare artificial key to segregate any five given plants

and must be recorded.

2. Students shall submit not less than 15 properly identified herbarium specimens of varying taxa during time of their practical examination.

3. It is compulsory that every student has to undertake a field study tour of not less than 3 days for observing plant diversity under the guidance of teachers of

the Department in the 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.

References

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

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

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

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

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

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

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

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

9. Jeffrey, C. 1968. An introduction to Plant Taxonomy, London. 10. Simpson,

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

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

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

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

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

15. Sharma, O.P. 1996. Plant Taxonomy. TATA McGraw Hill, New Delhi. 16. Clive A.

Stace 1991: Plant Taxonomy and Biosystematics, Cambridge University

Press.

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

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

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

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

Code: VBO5B07

[Total 99 hours: Theory 63, Practical 36]

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

1. Typical Angiosperm flower – morphology of floral organs 1 hr. 2. Anther - structure, dehiscence; microsporogenesis; male gametogenesis 3 hrs.

3. Ovule - structure, types; Megasporogenesis; Female gametogenesis: Monosporic, bisporic and tetrasporic. Structure of typical embryosac, Polygonum, Allium and Adoxa type 7 hrs

4. Fertilization, syngamy, and triple fusion, double fertilization. 1hr. 5. Endosperm formation - Types - Free nuclear, cellular and helobial 1hr.

6. Embryo - Structure of Dicot embryo- Capsella type and Mococot embryo - Sagittaria 3 hr.

7. Polyembryony - causes, types and significance 1 hr. 8. Parthenocarpy – induction and importance 1 hr.

PRACTICAL

Total - 9 hours ($^1/_2$ hour per week)
Students should identify

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

References

1. Bhojwani S & S.P. Bhatnagar 198. The Embryology of Angiosperms. Vikas Publishing House (P) Ltd.

2. Davis C.L. 1965. Systematic Embryology of Angiosperms. John Wiley, New York.

3. Eames M.S 1960. Morphology of Angiosperms Mc Graw Hill New York. 4. Johri BD 1984 (ed.) Embryology of Angiosperms Springer - Verlag, Berlin.

5. Maheswari P. 1985. Introduction to Embryology of Angiosperms - Mac Graw Hill, New York.

6. Sharam & Aswathi: Embryology of Angiosperms.

7. Agarwal S.B. Embryology of Angiosperms- a fundamental approach, Sahithya Bhavan, Hospital Road, Agra.

8. Singh V., P.C. Pande & D.K. Jain 2001;Embryology of Angiosperms RastogiPublications, 'Gangothri' Sivaji road, Meerut

PALYNOLOGY (12 hrs.)

1. Palynology- Introduction, Scope and Significance 2 hrs. 2. Pollen morphology – Acetolysis, Pollen wall features - fine structure, pollen kit substance; Pollinium. 2 hrs. 3. Pollination - different types, mechanisms and contrivances 2 hrs. 4. Pollen viability and pollen storage methods. 3 hrs.

5. Applied palynology: Aeropalynology; Melitopalynology, Pollen and allergy; Role of pollen morphology in Taxonomy 3 hrs

PRACTICALS (Total - 7 hrs.)

1. Viability test for pollen –*in vitro* germination using sugar solution (cavity slide method)
2. Viability test for pollen – Using Acetocarmine (Acetocarmine & Glycerine 1:1)

References

1. Erdtman G 1952. Pollen Morphology and plant Taxonomy Part I. Almiquist & Wicksell Stockholm

2. Erdtman G 1969. Hand Book of Palynology. National Botanical Gardens Publication, Lucknow.

3. Nair PKK 1970. Pollen Morphology of Angiosperms Vikas Publishing House, Delhi.

4. Saxena M.R. Palynology –A treatise-Oxford, I.B.H. New Delhi

5. Shivanna, K.R. & N.S. Rangaswami, 1993. Pollen Biollgy Narosa Publishing House - Delhi.

6. Shivanna & Johri. The Angiosperm Pollen.

ECONOMIC BOTANY (6 hrs)

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

1. Cereals and Millets – Rice, Wheat, Maize and Ragi
2. Pulses and legumes – Green gram, Bengal gram, Black gram,
3. Sugar – Sugar cane
4. Fruits – Apple, Pine Apple, Papaya, Banana, Mango, Guava, Jack, Grapes, Sapota.
5. Vegetables – Carrot, Beet Root, Corm, Potato, bitter gourd, Cucumber, Snake gourd, Ladies finger, Cabbage, *Amaranthus*,
6. Ornamentals – Rose, *Anthurium*, Jasmine.
7. Masticatories – Betel vine, Betel nut, Tobacco.
8. Beverages – Coffee, Tea, Cocoa.
9. Fibre – Coir, Cotton, Jute.
10. Timber – Teak, Rose wood, Jack, Ailanthus.
11. Fats and oils – Coconut, Gingelly, Sun flower.
12. Latex – Rubber
13. Gums and Resins – Dammar, Gum Arabic, Asafetida
14. Spices – Pepper, Ginger, Cardamom, Clove, Nutmeg, Allspice, Cinnamon
15. Medicinal – *Adhatoda*, *Catharanthus*, *Phyllanthus*, *Rauvolfia*, *Aloe*,

PRACTICALS (3 hrs)

1. Students shall be able to identify plants or plant products (raw or processed) studied in theory and shall be able to write Botanical names, Family and morphology of useful parts of source plants.
2. Students need not make any illustrations but make a table in the record giving the details of the items mentioned in the theory syllabus.

ETHNOBOTANY [Theory: 6 hrs.]

1. Introduction, scope and significance

2. Major tribes of South India

3. Ethanobotanic significance of the following:

1. Aegle marmelos

2. Ficus religiosa

3. Curcuma longa

4. Cynadon dactylon

5. Ocimum sanctum

6. Trichopus zeylanica

PRACTICALS [Total: 3 hrs]

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

References

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

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

Module - I.

1. Introduction, scope and significance; branches of horticulture.

2. Soil- components of soil, types of soil.

3. Fertilizers – Chemical, organic, biofertilizer, compost.

4. Pots & potting – earthen, fibre, polythene bags, potting mixture, potting, repotting, top dressing.

5. Irrigation – Surface, sprinkle, drip and gravity irrigation. 7 hrs **Module - II**

1. Seed propagation –seed quality tests, seed treatment, essential condition for successful propagation – raising of seed beds, transplanting techniques.

2. Vegetative propagation:

(a) Cutting (stem, roots)

(b) Grafting (approach, cleft)

(c) Budding (T-budding, patch)

(d) Layering (simple, air). 7 hrs **Module - III**.

1. Gardening – site selection; propagating structure: green house, poly house, moist chamber, net frame – Garden tools and implements.

2. Indoor gardening – selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, creating the bonsai.

3. Outdoor gardening; landscaping- goals, types.

4. Cultivation and post harvest management of vegetables (Chilli, Bittergourd) and ornamental plants (Jasmine , Anthurium)

5. Protection of Horticultural plants: Precautions to avoid pests and diseases. Bio pesticides

6. Mushroom cultivation – Oyster mushroom 7 hrs PRACTICALS Practical 14 hours

1. Preparation of nursery bed and polybag filling.

2. Preparation of potting mixture – Potting, repotting.

3. Field work in cutting, grafting, budding, layering.

4. Familiarizing gardening tools and implements.

5. Visit to a horticulture station and submission of report.

References

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

2. Andiance and Brison. 1971. Propagation Horticultural Plants. 3. Rekha Sarin. The Art of Flower Arrangement, UBS Publishers, New Delhi. 4. Katyal, S.C., Vegetable growing in India, Oxford, New York. 5. Naik, K.C., South Indian Fruits and their Culture.

6. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India. 7. Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.

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

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

10. Kumar, U.: Methods in Plant Tissue Culture. Agrobios (India), Jodhpur. 11. Kolay, A.K. Basic Concepts of Soil Science. New Age International Publishers, Delhi.

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

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

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

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

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

17. George Aquah 2005: Horticulture

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-8: GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY AND MOLECULAR BIOLOGY
Code: VBO5B08

[Total 108 hours: Theory 72, Practical 36]

GENERAL INFORMATICS & BIOINFORMATICS
Theory: **18 hrs. [1 hr. per week]**

Module-I

1. Definition, salient features and scope of information technology. 2. Internet as a knowledge repository, data and metadata. Internet protocols – IP address and Domain Name System, URL.

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

4. IT in teaching, learning and research: Academic web sites, e-journals, Open access initiatives and open accesspublishing, education software, academic services - INFLIBNET, NICNET,BRNET.

Module – II

1. IT Application: e-governance at national and state levels, overview of IT application in medicine, weather forecasting, education,

2. Artificial intelligence, virtual reality, bio-computing.

Module- III

1. Introduction to Bioinformatics, scope and relevance.

2. Genomics and Proteomics; Nucleotide sequence database –Gen Bank,

3. Proteomics :Protein sequence database – PDB, protein structure prediction and modelling (Brief account only)

4. sequence alignment types and tools: pair wise sequence alignment – BLAST, multiple sequence alignment- clustal

5. Human genome project

PRACTICAL Total: 9 hrs.

1. Familiarising various search engines and sites.
2. Familiarizing with the different data bases mentioned in the syllabus.
3. Demonstration of Blast search of nucleotide sequences.

Reference

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

MOLECULAR BIOLOGY

Theory -27 Hrs. [1½hrs per week]

Module – I.

1. Nucleic acids - DNA – the genetic material; the discovery of DNA as the genetic material; bacterial transformation (Griffith's & Avery's experiments); Hershey and Chase experiment; Structure of DNA, Watson & Crick's Model, Types of DNA-(A,B,Z); Replication –semi conservative replication – Meselson and Stahl's experiment; Molecular mechanism of Replication 10 hrs.

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

3. Gene action - One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis; concept of colinearity; modern concept of gene-cistorns, recons and Mutons 3 hrs.

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

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

6. Gene regulation in prokaryotes - operon concept, (Lac operon, trp. operon) 1 hr. 7. Gene regulation in eukaryotes (brief account) 2 hrs. 8. Mutation-spontaneous and induced; causes and consequences. Types of

mutagens and their effects. Point mutations- molecular mechanism of mutation Transition, Transversion and substitution 3 hrs.

References

1. Brown T A. Genomes. John Willey and Sons

2. Lewin Benjamin. Genes. Oxford University Press

3. Hawkins, J D. Gene Structure and Expression. Cambridge University Press

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

INTRODUCTORY BIOTECHNOLOGY

Theory: 27 hours [1½ hrs per week]

Module-1

1. The concept of biotechnology, landmarks in the history of biotechnology.
2. Plant tissue culture – Principles and techniques; Cellular totipotency; in vitro differentiation – de differentiation and re-differentiation.

3. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium; Murashige and Skoog medium – composition and preparation.

4. Aseptic techniques in *in vitro* culture – sterilization – different methods – sterilization of instruments and glassware, medium, explants; working principle of laminar air flow and autoclave.

5. Preparation of explants – surface sterilization, inoculation, incubation, subculturing.

6. Micropropagation - Different methods – apical, axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis.

7. Different phases of micropropagation – multiple shoot induction, shoot elongation, *in vitro* and *in vivo* rooting hardening, transplantation and field

evaluation; Advantages and disadvantages of micropropogation. Somaclonal variation.

12 hrs

Module – II

1. Methods and Applications of tissue culture:
   a. Shoot tip and meristem culture
   b. Somatic embryogenesis and synthetic seed production
   c. Embryo culture
   d. Protoplast isolation culture and regeneration – transformation and transgenics
   e. Somatic cell hybridization, cybridization.
   f. In vitro secondary metabolite production — cell immobilization, bioreactors
   g. In vitro production of haploids – anther and pollen culture
   h. In vitro preservation of germplasm 15 hrs **PRACTICALS [**Total: 27 hrs]

1. Preparation of nutrient medium – Murashige and Skoog medium using stock solutions,
2. Familiarize the technique of preparation of explants, surface sterilization, inoculation and subculturing
3. Demonstration of anther culture

References

1. Brown TA (2006) Gene cloning and DNA anlaysis; Blackwell scientific publishers
2. Chawla HS (2000) Introduction to Plant Biotechnology
3. Das, H.K. (Ed) 2005. Text book of Biotechnology (2nd ed) Wiley India (Pvt.), Ltd. New Delhi.

4. Dubey RC Introduction to Plant Biotechnology; S Chand & Co

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

6. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut. 7.

Hammond, J., Megary, P *et al.* 2000. Plant Biotechnology. Springerverlag. 8.

Ignacimuthu S (1997) Plant Biotechnology, New Hampshire Science Publishers 9.

Lewin B (2004) Genes VIII. Oxford University Press

10. Purohit SS (2003) Agricultural Biotechnology, Agrobios (India)

11. Razdan MK (1995) Introduction to Plant Tissue Culture. Oxford & IBH publishing Co. Pvt. Ltd.

12. Reinert & Bajaj Plant Cell, Tissue and Organ Culture.

13. Sobti RC & Pachauri SS (2009) Essentials of Biotechnology; Ane Books, New Delhi.

OPEN COURSE

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

OPEN COURSE : PLANT TISSUE CULTURE
Code: VBO5D01

Total – 36 hrs.

Module - I

1. Introduction; Aims and objectives of Plant Tissue Culture.
2. Organization and facilities of a Tissue culture Laboratory.
3. Equipments and apparatus in a tissue culture lab.
4. Sterilization techniques – Autoclaving Flame sterilization, UV irradiation, Chemical sterilization. Sterilization of instruments and glass wares, medium, explants 6 hrs

Module-II

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

Module-III

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

10 hrs.

Module – IV

1. Applications of plant tissue culture: Micropropagation; Somatic embryogenesis; Artificial seeds, Embryo rescue culture, Anther, pollen and Ovary culture for production of haploids, Cryopreservation. Shoot apical meristem culture and production of pathogen free stocks. 10hrs

References

1. Dixon, R.A. & R.A. Gonzales. 1994. Plant Cell Culture – A Practical Approach (2^{nd} Ed) Oxford University Press.
2. Mantel & Smith (1983) Plant Biotechnology. Cambridge University Press
3. Mantel, S. H, Mathew, J.A. et al. 1985 An introduction to Genetic Engineering in plants. Blackwell Scientific Publishers, London.
4. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.
5. Hammond, J., Megary, P et al. 2000. Plant Biotechnology. Springerverlag.
6. Gamborg, O.L. & G.C. Philips (Eds.) 1995. Plant Cell, Tissue and Organ Culture Fundamental Methods. Narosa Pulishing House, New Delhi.
7. einert & Bajaj Plant Cell, Tissue and Organ Culture.
8. Das, H.K. (Ed) 2005. Text book of Biotechnology (2^{nd} ed) Wiley India (Pvt.) Ltd. New Delhi.

OPEN COURSE - Choice - 2: APPLIED BOTANY
Code: VBO5D02

Total – 54 hrs.

Module –I PLANT PROPAGATION

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

Module – II STEPS OF GROWING PLANTS

1. Soil- Composition, Types, Texture, Soil pH, Correcting pH, Humus
2. Pots & Potting – Earthen, Fibre, Polythene bags, Potting mixture, Potting, Depotting, Repotting.
2. Chemical fertilizers: types, application, merits and demerits 3.

Organic manure; types, application, merts and demarits

4. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers. 5. Plant protection: Biological, Physical and mechanical, Chemical, biopestcide 12 hrs.

Module – III. BOTANY IN EVERY DAY LIFE

1. Vegetable gardening
2. Mushroom cultivation
3. Vermi composting- technique
4. Biofertlizer Technology
5. Orchid and Anthurium cultivation
6. Creating Bonsai 20 hrs. MODULE – IV. ECONOMIC BOTANY

1. General account on various plants of economic importance

2. Study the Binomial, Family, Morphology of the useful part of the following plants.
   a. Cereals and Millets – Rice, Wheat
   b. Pulses -Greengram, Bengalgram, Blackgram
   c. Beverages – Coffee, Tea, Cocoa.

d. Fibre – Coir, Cotton

3. Timber – Teak, Rose wood, Jack

4. Spices – Pepper, Ginger, Cardamom

5. Medicinal – Adhatoda, Phyllanthus, Rauvolfia

6. Oil- coconut, Gingelly

7. Ornamentalants of economic importance – Rose, jasmine

8. Fruit – Mango, Banana 10 hrs. **References**

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

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

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

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

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

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

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

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

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

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

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

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

FIFTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

OPEN COURSE - Choice -1: GENERAL BOTANY
Code: VBO5D03

Total – 54 hrs

Module -1: Living World

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

6 hrs.

Module - 2: Morphology of Angiosperms

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

6 hrs.

Module - 3: Anatomy

Definition, general structure, Cell division- mitosis and meiosis, significance, cell cycle. Tissues: simple , compound; structre and functions; Structure and functions of root, stem and leaves. Monocot and Dicot stem- general features; Secondary thickening. Annual rings, heart wood and sap wood. 6 hrs

Module- 4: Plant physiology

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

Module - 5: Genetics

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

6 hrs.

Module - 6: Plant Biotechnology

Tissue culture - Principle and procedure; Transgenic plants: Scope and applications, BT Cotton, BT Brinjal, Golden Rice; Bioreactors and their significance. 6 hrs. **Module - 7 Environmental Science**

Ecosystem: Structure - Abiotic and Biotic Factors, Ecosystem:, Types of plant interactions; Mutualism, Commensalism, Predation, Symbiosis, Parasitism, Competition. Biodiversity, Conservation, *In situ* and *Ex situ* methods, National Parks, Sanctuaries, IUCN, Threat Categories, Red list. Green House Effect, Ozone depletion, Deforestation and Reforestation, Alternative energy resources, Sustainable development and Utilization of resources. 12 hrs.

References

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

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

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

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

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

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

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

8. 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- 9: GENETICS AND PLANT BREEDING

Code: VBO6B09

[Total 90 hours: Theory 54, Practical 36]

GENETICS Theory: 40 hrs.

Module - I

1. Introduction- Brief account of Mendel's life history: Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance; Back cross, test cross. 5 hrs. 2. Modified Mendelian ratios:

a. Allelic interactions: dominant – recessive, Incomplete dominance - flower color in Mirabilis; Co dominance – Coat colour in cattle, Blood group in human beings; Lethal genes – Sickle cell anemia in Human beings. 5 hrs

b. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry (9:3:3:1): Epistasis: dominant - Fruit colour in summer squashes; recessive epistasis - Coat color in mice; Complementary gene interaction- flower color in Lathyrus . 5 hrs 3. Multiple alleles- general account: ABO blood group in man, Self sterility in Nicotiana, Coat colour in Rabbits. 3 hrs 4. Quantitative inheritance / polygenic inheritance / continuous variation Skin color in human beings, Ear size in maize. 3 hrs **Module -II**

1. Linkage and crossing over- importance of linkage, linkage and independent assortment. Complete and incomplete linkage. Crossing over-general account, 2 point and 3 – point crossing over, cytological evidence of genetic crossing over. Determination of gene sequences; interference and coincidence; mapping of chromosomes. 7 hrs.

2. Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (Melandrium album); genic balance theory of sex determination in Drosophila; sex chromosomal abnormalities in man. 4 hrs.

3.Sex linked inheritance: X-linked, Y-linked; Eye color in Drosophila, Haemophilia in man; Y-linked inheritance; Sex limited inheritance. 3 hrs.

4.Extra nuclear inheritance- general account- maternal influence- plastid inheritance in Mirabilis, Shell coiling in snails. 4 hrs 5Population Genetics – brief account 1 Hr.

PRACTICAL Total: 27 hours.

1. Students are expected to work out problems related to the theory syllabus and recorded.

a. Monohybrid cross

b. Dihybrid cross

c. Test cross and back cross

d. Determination of genotypic and phenotypic ratios and genotype of parents

e. Non epistasis

f. Complementary gene interaction

g. Epitasis: dominant and recessive

h. Polygenic interaction

i. Multiple allelism

j. Chromosome mapping

Reference:

1. Gunther, S. Spend & Richard Calender 1986 - Molecular Genetics CBS Publishers - Delhi.

2. Gupta, P.K. Text Book of Genetics. Rastogi Publications, Meerut. 3.

John Ringo 2004- Fundamental Genetics Cambridge University Press. 3

Lewin B. 2000 Genes VII Oxford University Press.

4 RastogiV.B. 2008, Fundamentals of Molecular Biology, Ane Books, India.

6. Sinnot, W.L.C. Dunn & J. Dobzhansky 1996. Principles of Genetics. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

7. Taylor, D.J., Green, N.P.O. and Stout, G.W. Biological Science 3rd edn. Cambridge University Press.

8. Verma, P.S. & Agarwal 1999. Text book of Genetics. S. Chand & Co., New Delhi.

PLANT BREEDING Total: 14 hrs. [¾ hr. per week)

Module-I

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

Module-II

1. Breeding techniques –

a. Plant introduction: Procedure, quarantine regulations, acclimatization

agencies of plant introduction in India, major achievements.

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

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

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

e. Mutation breeding – methods,- achievements.

f. Polyploidy breeding

g. Breeding for disease and stress resistance 10 hrs.

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

PRACTICAL 9 hrs

1. Techniques of emasculation and hybridization of any bisexual flower.
2. Study of Floral biology -Paddy
3. Visit to a plant breeding station and submission of its report.

References

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

2. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.

3. Singh, B.D. 2005. Plant Breeding - Principles & methods , Kalyani Publishers, New Delhi.

4. Sinha U. & Sunitha Sinha 2000 - Cytogenetics, Plant breeding & Evolution, Vikas Publishing House.

5 Swaminathan, Gupta & Sinha - Cytogenetics of Crop plants

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-10: PLANT PHYSIOLOGY AND METABOLISM Code: VBO6B10

[Total 72 hours: Theory 54, Practical 36]

Module - 1.

1. Plant cell and Water

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

2. Transpiration. Types and process. Mechanism of guard cell movement. K^+ ion mechanism. Why transpiration? Antitranspirants.

3. Absorption of water by transpiration pull and cohesion of water molecules. Radial movement of water through root. Soil-plant-atmosphere continuum of water. 9 hrs

Module-II

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

2. Plants and inorganic nutrients. Macro and Micro nutrients. Uptake of mineral elements. Difference between passive uptake and active uptake. Simple and facilitated diffusion. Active uptake. Carrier concept. Evidences.

6 hrs.

Module - III

1. Photosynthesis in higher plants: Photosynthetic apparatus. Electromagnetic radiation. Absorption of light. Fluorescence and phosphorescene. Organization of light harvesting antenna pigments. Photochemical and chemical phases of photosynthesis and its evidences. Red drop and Emerson enhancement effect. Two pigment systems, components. Redox potentials of the electron carriers. Photosynthetic electron transport and photophosphorylation. Assimilatory powers- ATP and NADPH. Photosynthetic carbon reduction cycle (PCR), RUBISCO, C3. C4, and CAM

pathways. Ecological significance of C4, and CAM metabolism. Photorespiration. Law of limiting factors. 8 hrs.

2. Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of Nitrogen fixation. Export of fixed nitrogen from nodules. Genetics of nitrogen fixation, Ammonia assimilation, assimilation of nitrate. Biosynthesis of amino acids reductive amination and transamination. 4 hrs.

3. Translocation and distribution of photo assimilates. Composition of phloem exudates. Mechanism of phloem transport. Phloem loading and unloading; pressure flow hypothesis 4 hrs **Module - IV**

1. Plant growth and development. Auxins, gibberellins, cytokinins, abscisic acid and ethylene, their physiological roles. Photoperiodism and vernalization.

2. Plant movements -Phototropism, gravitropism. Nyctinastic and seismonatic movements.

3. Photomorphogenesis: Phytochrome: chemistry and physiological effects. 4. Seed dormancy and germination. 6 hrs. **Module – V**

1. Intermediary metabolism: anabolism, catabolism, amphibolic pathways and anapleurotic reactions. 3 hrs

2. Catabolism of hexoses. Glycolysis: Two phases of glycolysis. Overall balance sheet. Fate of pyruvate under aerobic and anaerobic conditions. Citric acid cycle: Formation of acetate, Reaction of citric acid cycle, Anapleurotic reactions of citric acid cycle. Amphibolic nature of citric acid cycle. 3hrs

3. Oxidation of fatty acids. β oxidation of saturated fatty acids in plants. Glyoxylate cycle. 3 hrs 4. Biosynthesis of saturated fatty acids in plants. Involvement of fatty acid synthase complex and acyl carrier protein. 3 hrs 5. Oxidation of amino acids and entry to TCA cycle. 2 hrs

6. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers function as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis. Shuttle systems. 3 hrs

Practicals 36 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. Relation between water absorption and transpiration.

3. Separation of leaf pigments by paper chromatography/ column chromatography/TLC.

4. Effects of light intensity on photosynthesis by Wilmot's bubbler.

5. Ganong's Potometer

6. Ganong's light-screen

7. Ganong's respirometer

8. Kuhne's fermentation vessel

9. Mohl's half-leaf experiment

10.Experiment to demonstrate suction due to transpiration

11. Demonstration of gravitropism using Klinostat.

References

9. William G. l-lopkins,(1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.

10. Lincoln Taiz and Eduardo Zeiger (2002). Plant Physiology 2nd edition. Sinauer Associates, Inc.Publishers. Sunderland, Massachusetts.

11. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributers.

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

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SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-11: CELL BIOLOGY AND

BIOCHEMISTRY Code: VBO6B11

[Total 90 hours: Theory 54, Practical 36]

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

Module – I.

1. Architecture of cells. Prokaryotic and Eukaryotic cells. 2 hrs. 2. Structure and function of the following:

a. Cell membrane (fluid mosaic model),

b. Endoplasmic reticulum,

c. Golgi complex,

d. mitochondria

e. chloroplast,

f. Lysosomes

g. Glyoxisomes

h. Ribosomes

i. Cytoskeleton

j. Cytosol

k. Vacuole 7 hrs.

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

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

Module-II

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

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

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

4. Numerical aberration - Defintion - Basic chromosome number (Genomic Number) Aneuploidy, Haploidy and Polyploidy - their meiotic behaviour and significance. 12 hrs.

PRACTICALS [Total: 9 hrs.]

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

2. Calculation of mitotic index

3. Demonstration of meiosis in Rhoeo/Chlorophytum and identification of different stages of Meiosis.

Reference

1. Arumugham. N. Cell Biology. Sara Publication, Nagercoil.

2. Avinash Upadhyaya & Kakoli Upadhayayo 2005. Basic Molecular Biology. Himalaya Publishers.

3. De Robertis. E.D.P., & De Robertis E.M.S. 1998 Cell and Molecular Biology - Lea & Febiger.

4. Geoffery M. Cooper & Robert E. Haufman. 2007. The cell - a molecular approach. A.S.S. Press Washington, U.S.A.

5. Lewis. J. Kleinsmith & Valerie M. Kish 1995. Principles of Cell & Molecular Biology.

6. Lewin B. Genes VII. Oxford University press.

7. Lodish. H. et. al., 2000. Molecular Cell Biology, Freeman & Company. 8. Powar C.B. 1988. Essentials of Cytology, Himalaya Publishing House. 9. Rastogi S.G. Cell Biology. Tata Mc Graw Hill Publishing Company New Delhi 10. Rastogi. V.B. 2008. Fundamentals of Molecular Biology, Ane Books India.

BIOCHEMISTRY Total: 27 hrs. [$1\frac{1}{2}$ hrs. per week]

1. Macromolecules-building block biomolecules - metabolic intermediates precursors). 3 hrs.

2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates. 3 hrs.

3. Lipids. Classification. Complex lipids, Simple lipids and derived lipids; Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids. 4 hrs.

4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; zwitterions, Dipeptides. 3 hrs.

5. Proteins: Primary, secondary, tertiary and quarternry structures of proteins.

Native comformation and biological functions of proteins. Denaturation and renaturation. 4 hrs.

6. Nucleotides structure of nucleotides. Functions of nucleotides and nucleotide derivatives. 3 hrs.

7. Secondary metabolites. A brief account of secondary metabolites, physiological roles. Significance: ecological importance. 3 hrs.

8. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, covalently modulated enzymes. Isoenzymes. 4 hrs.

PRACTICALS 27 hrs.

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

a. Molisch's test for all carbohydrates

b. Benedict's test for reducing sugars

c. Barfoed's test for monosaccharides

d. Seliwanoff's test for ketoses

e. Iodine test for starch

f. Ninhydrin test for amino acids and protein

g. Xanthoproteic test for amino acids with aromatic R-groups

h. Millon's test for tyrosine

k. Biuret test for peptide linkage and proteins

References:

1. David L; Nelson and Michael M Cox (2000).Lehninger. Principles of Biochemistry. 3rd edition. Macmillon, Worth U.K.

2. Geoffrey Zubay Biochemistry Macmillen Publishing Company, Newyork

3. David T. Plummer, An Introduction to Practical Biochemistry. Tata Mc Grow Hill.

4. Sadasivam and Manickam, Biochemical methods. New Age International

Publishers. New Delhi.

5. Secondary plant products, vol.8. Encyclopedia of Plant Physiology, 1980, Springer – Verlag, Berlin (This book is available in the library of Department of Botany, University of Calicut).

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

7. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.

8. Keith Wilson and John Walker.(2008). Principles and techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.

9. Trevor Palmer. Enzymes- Biochemistry, Biotechnology and Clinical Chemistry. Norwood Publishing, Chichester.

10. Donald Voet and Judith Voet. (2004). Biochemistry. 3rd edition. Wiley international edition.

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME

CORE COURSE-12: ENVIRONMENTAL SCIENCE
Code: VBO6B12

[Total 72 hours: Theory 54, Practical 36]

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

Module - I

1. Ecosystem – Definition ; abiotic and biotic factors; trophic structure; Food chain and food web; Ecological pyramids; Energy flow; Productivity of ecosystems.

2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous)

3. Plant adaptations: Adaptations in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.

4. Succession: Definition – Primary and Secondary succession; Autogenic and and allogenic succession; Mechanism of plant succession– Xerosere, Hydrosere 15 hrs **Module-II**

1. Biodiversity and Conservation: Definition; Biodiversity - Global and Indian Scenario; Megadiversity nations and hotspots: Biosphere reserves; Biodiversity centres in India.

2. Threats to biodiversity; Endangered and endemic plant species – Red data book - Exotic and indigenous plant species – Keystone species – Flagship species.

3. Conservation strategies ex situ and in situ methods. Organizations – IUCN, UNEP & WWF; (NBPGR) Biodiversity Board of Kerala (KSBDB). 10 hrs.

Module-III

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

2. Global environmental changes – climatic changes – global warming and greenhouse gases – acid rains – el-nino – Efforts of world organizations in

the regulation of green house gases emission.

3. Management of environmental pollution – conventional and phytotechnological approaches – solid wastes management including e wastes-environmental legislations in India (Prevention and Control of Pollution act, 1981). 15 hrs.

Module- IV

1. Major ecosystems of the Biosphere; Sea; Estuarine ecosystem; Lentic ecosystem: lake, Pond; Lotic ecosystem: river; Desert; Forest; grass land.

2. Techniques in plant community studies – Quadrat and transect methods – species area curve – density, frequency, abundance, dominance of populations – importance value index – construction of phytographs. 14 hrs.

PRACTICALS [Total: 36 Hrs.]

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

References

1. Ahluvalia V.K. Malhotra S. 2009. Environmental Science. Ane Books – New Delhi.
2. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co.Varanasi.
3. Beeby A. & Brennan A.M. First Ecology. Ecological Principles and Environmental Issues. International Student Edition.
4. Benon E. Plant Conservation Biotechnology. Taylor & Francis Ltd. II New Felter Lane, London. EC4P4EE.
5. Cunninghan W.P. and M.A. Cunningham 2003. Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.
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Company Ltd. New Delhi.

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10. Michael S. 1996. Ecology. Oxford University Press, London.
11. Mishra D.D 2008. Fundamental Concepts in Environmental Studies. S. Chand & Co., New Delhi.
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13. Odum E.P. 1983. Basics of Ecology. Saunders International UN Edition.
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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.
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19. Futuyma P.J., Slatkin M. 1983. Co-evolution. Sinauer Associates, Sunderland, Mass.
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