

VIMALA COLLEGE (AUTONOMOUS)

(NAAC Re-accredited (3rd Cycle): A Grade, CGPA-3.50)

College with potential for Excellence

(Affiliated to University of Calicut)



DEGREE OF BACHELOR OF SCIENCE (B.Sc) IN BOTANY (Choice Based Credit and Semester System)

**SYLLABUS, SCHEME AND MODEL QUESTION PAPERS FOR
CORE, COMPLEMENTARY AND OPEN COURSES**

(2016 ADMISSION ONWARDS)

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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
2. To undertake scientific projects
3. To give better exposure to the diversity of life forms
4. To give awareness about natural resources and their importance in sustainable development
1. To provide opportunities for the application of the acquired knowledge in day to day life.
2. 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 first letter V which stands for Vimala College ,abbreviation of the subject in two 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, VBO2B03 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).

Credit Distribution of B.Sc. Botany Programme

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

*Credits of Practical Exam

** Credits of Project Work



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



SEMESTERWISE DISTRIBUTION OF CREDITS AND MARKS

Total Credits: 120; Total Marks: 3600

<i>Semester</i>	<i>Course</i>	<i>Credit</i>	<i>Marks</i>
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 & Microtechnique	3	100
	Complementary course: Chemistry	2	80
	Complementary course: Zoology	2	80
		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
		15	460
IV	Common course: English	4	100
	Common course: Additional Language	4	100



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

- 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.
- External evaluation of the project shall be done by the external examiner appointed by the University along with practical examinations.
- Marks secured for the project will be awarded to the candidate after totaling the internal and external marks
- While totaling, the internal and external marks is to be taken in the ratio 1:4.

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	10
		Use of statistical tools, Findings and recommendations	
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.

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

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

**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

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

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

- Content should cover the entire practical works mentioned under individual courses
- Neatness and scientific accuracy
- 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.

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

Course structure, Work load and Credit distribution
B.Sc. PROGRAMME IN BOTANY- Core

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours Week	Credit
S- I	VBO1B01	Angiosperm Anatomy	36 hrs	2	3
		Core Course. Practical –I	36 hrs	2	
S -II	VBO2B02	.Research Methodology & Microtechnique	36 hrs	2	3
		Core Course. Practical –II	36 hrs	2	
S-III	VBO3B03	Microbiology, Mycology, Lichenology & Plant Pathology	54 hrs	3	3
		Core Course. Practical –III	36 hrs	2	
S-IV	VBO4B04	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	Gymnosperms, Palaeobotany, Phytogeography & Evolution	63 hrs	3.5	3
		Core Course. Practical –V	36 hrs	2	
	VBO5B06	Angiosperm Morphology & Plant Systematics	72 hrs	4	4
		Core Course. Practical –VI	36 hrs	2	
	VBO5B07	Embryology, Palynology, Economic Botany, Ethanobotany & Horticulture	63 hrs	3.5	4
		Core Course. Practical VII	36 hrs	2	
	VBO5B08	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	
	VBO5D02	Open Course	36 hrs		



		Applied Botany			2
	VBO5D03	Open Course General Botany	36 hrs		
S – VI	VBO6B09	Genetics & Plant Breeding	54hrs	3	3
		Core Course. Practical IX	36 hrs	2	
	VBO6B10	Plant Physiology & Metabolism	54hrs	3	3
		Core Course. Practical – X	36 hrs	2	
	VBO6B11	Cell Biology & Biochemistry	54hrs	3	3
		Core Course. Practical - XI	36 hrs	2	
	VBO6B12	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
	VBO6PR	Project Work		1	2



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

Course structure and mark distribution

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. PL-III Record Submission			3hrs			80 20 10	20	100 20 10
Record of Elective Paper						10		10
VBO6PR Project work PR						40	10	50
Total				1080	270	380	70	1800

EE* *- External Evaluation marks ;

IE* - Internal Evaluation marks

Model question- Subject wise distribution of marks

**Core Course -1
PLANT ANATOMY**

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

**Core Course – 2
RESEARCH METHODOLOGY & MICROTECHNIQUE**

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

**Core Course- 3
MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY**

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

Core Course- 4

PHYCOLOGY, BRYOLOGY & PTERIDOLOGY

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

Core Course – 5

GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY & EVOLUTION

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

Core Course – 6

ANGIOSPERM MORPHOLOGY, PLANT SYSTEMATICS

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

Core Course – 7
EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY AND
HORTICULTURE

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

Core Course - 8
GENERAL AND BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY
& MOLECULAR BIOLOGY

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

OPEN COURSE
OPEN COURSE : PLANT TISSUE CULTURE

Type of questions	Module 1	Module 2	Module 3	Module 4	Total
1 mark	1	1	1	1	4x1=4
2 marks	2	2	2	4	2x5=10
5 marks	4	4	4	4	4x4=16
10 marks	-	-	1	-	1x10=10

Core Course - 9
GENETICS & PLANT BREEDING

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

Core Course – 10
PLANT PHYSIOLOGY AND METABOLISM

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



Core Course – 11
CELL BIOLOGY & BIOCHEMISTRY

Type of questions	Cell biology	Biochemistry	Total
1 mark	5	5	10x1=10
2 marks	5	5	10x2=20
5 marks	4	4	6x5 =30
10 marks	2	1	2x10=20

Core Course – 12
ENVIRONMENTAL SCIENCE

Type of questions	Module I	Module II	Module III	Module IV	Total
1 mark	3	1	3	3	10x1=10
2 marks	3	2	3	2	10x2=20
5 marks	2	2	2	2	6x5 =30
10 marks	1	1	-	-	2x10=20

B.Sc. PROGRAMME IN BOTANY- Complementary
Course structure, Work load and Credit distribution

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours allotted / Week	Credit
S- I	VBO1C01	Complementary Course I. Angiosperm Anatomy & Micro technique	36 hrs	2	2
		Complementary Course Practical – I	36 hrs	2	
S -II	VBO2C02	Complementary Course II. Cryptogams, Gymnosperms & Plant Pathology	36 hrs	2	2



		Complementary Course Practical –II	36 hrs	2	
S-III	VBO3C03	Complementary Course - III. Morphology, Systematic Botany, Eco. Botany, Plant Breeding & Horticulture	54 hrs	3	2
		Complementary Course practical -III	36 hrs	2	
S-IV	VBO4C04	Complementary Course - IV. Plant Physiology, Ecology & Genetics	54 hrs	3	2
		Complementary Course practical -IV	36 hrs	2	
	VBO4CPL	External Practical Examination			4



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

Course code & Title of course	Instructional Hours		Duration of Exams	Marks				Total
	Theory	Practical		Theory		Practical		
				EE	CIE	EE	CIE	
Semester –I VBO1C01 Anatomy & Micro technique	36	36	3 hrs	64	16	--	--	80
Semester-II VBO2C02 Cryptogams, Gymnosperms & Plant Pathology	36	36	3 hrs	64	16	--	--	80
Semeser-III VBO3C03 Morphology, Syst. Botany, Eco. Botany, Plant Breeding & Horticulture	54	36	3hrs	64	16	--	--	80
Semester-III VBO4C04 Plant Physiology, Ecology & Genetics	54	36	3hrs	64	16	--	--	80
VBO4CPL Comp.course Practical Ext. Exam -50 Record-10 submission -4			3hrs	--		64 [50+10+4]	16	80
Total	180	144		256	64	64	16	400

SCHEME OF EVALUATION

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

Theory Examination

Total	-	80 marks
External	-	64 marks
Internal	-	16 marks

Distribution of internal marks [Theory]

Attendance	-	4
Test paper	-	8
Seminar & assignment		4
Total		16

Practical Examination

Total	-	80 marks
External	-	64 marks {Ext.Exam -50, Record-10, Submn-4}
Internal	-	16 marks

Distribution of internal marks [Practical]

Attendance	-	4
Record	-	8
Lab involvement & test-		4
Total		16

Submission

Students are expected to submit 8 duly certified Herbarium sheets on the day of Practical examination.

FIRST SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
CORE COURSE 1- ANGIOSPERM ANATOMY Code: VBO1B01

[Total 72 hours: Theory 36, Practical 36]

ANGIOSPERM ANATOMY

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 .2hrs
 - 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 - amphicribal and amphivasal. 2Hrs

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 (Metcalf & 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, secondary 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*

References

1. Cuttler, EG. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
2. Cuttler, E.G. 1971. Plant Anatomy, Part III Organs Edward Arnold Ltd., London.
3. Eames, A. J. & L H Mac Daniels 1987 An Introduction to Plant Anatomy. Tata Mac Grew Hill Publishing company Ltd. New Delhi.
4. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
5. Fahn A 2000. Plant Anatomy. Permagon Press.
6. Pandey B.P. Plant Anatomy, S. Chand & Co. Delhi.
8. Tayal M.S Plant Anatomy. Rastogi Publishers, Meerut.

9. Vasishta P.C. 1974. Plant Anatomy, Pradeep Publication, Jalandhar.

SECOND SEMESTER
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 to science –Definition, Science and not Science, Meaning, Objectives, Types and Significance of Research

1.Steps in scientific methods

- Observation
- Hypothesis , Types
- Kinds of experiments
- Replication, Repeatability, Error
- Interpretation- Induction, Deduction
- Documentation
- Record Keeping
- Research Report Writing
- Journals
- Presentation

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.

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. (ed). 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, coal tar 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 Microtechnique. 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

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, Virioids, 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. Merrill 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.) [1½ 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 (4th ed) Academic Press.
2. Bilgrami K.H. & H.C. Dube. 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Mehrotra, R.S. 1980. Plant Pathology – TMH, New Delhi.
4. Pandey, B.P. 1999. Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.
5. Rangaswami, G. 1999. Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.
6. Sharma P.D. 2004. Plant Pathology Rastogi Publishers.

FOURTH SEMESTER CORE COURSE - 4

VBO4B04: PHYCOLOGY, BRYOLOGY, PTERIDOLOGY, PHYCOLOGY

[Total 90 hours: Theory 54, Practical 36]
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 [$\frac{1}{2}$ 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 $\frac{1}{2}$ hr.
5. Fossil Bryophytes $\frac{1}{2}$ 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, Cryptogramic 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* (Lycopside) 2 hrs.
 - b. *Psilotum* (Psilotopsida) 2 hrs.
 - c. *Equisetum* (Equisetopsida) 2 hrs.
 - d. *Pteris* & *Marsilea* (Polypodiopsida) 4 hrs.
3. Apogamy and apospory in Pteridophytes; Stellar 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. per week]

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

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

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

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

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

References

1. Bower, F.O. 1935, Primitive Land Plants – Cambridge, London.
2. Chandra S. & Srivastava M., 2003, Pteridology in New Millennium, Kluwer 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, Allahabad.
5. Rashid, A. 1976, An Introduction to Pteridophyta, Vikas publ. Co. New Delhi.
6. Ranker, T.A. & Haufler, C.H. (eds.), 2008. *Biology and Evolution of Ferns and Lycophytes*. Cambridge University Press.
7. Mehlreter, K., Walker, L.R. & Sharpe, J.M. (eds.) 2010. *Fern Ecology*. Cambridge University Press.
8. Smith, A.R., Pryer, K.M., Schupp, E., Korall, P., Schneider, 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
CORE COURSE -5: GYMNOSPERMS, PALAEOBOTANY,
PHYTOGEOGRAPHY, EVOLUTION Code: VBO5B05

[Total 99 hours: Theory 63, Practical 36]

GYMNASPERMS

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, male cone 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, Palaeobotany, 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, Fossil 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 hypothesis | 3 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; Protienoids and Prions – Oparin's concept; Miller's experiment. 3 hrs.
3. Evolution of prokaryotic and eukaryotic cells. Archaeobacteria – 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

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, thyrus) 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 (5th Ed.) New Central Book Agency, Calcutta.
2. George, H.M. Lawrence. 1951. Introduction to Plant Taxonomy. Mac Millan comp. Ltd., New York.
3. Simpson, M. G. 2006. Plant Systematics. Elsevier Academic Press, London
4. Ananta Rao T. Morphology of Angiosperms.

SYSTEMATICS Theory: 45 hrs. [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 systems; Phenetics; Cladistics (Brief account of various phases). 2 hrs
3. Systems of classification: Artificial – Linnaeus; Natural – Bentham 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. 5 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 botanica Garden, Olavanna , Kozhikode. 3 hrs
4. Taxonomic literature- Floras, Monographs, Revisions, Journals and online resources & Databases. 2 hrs.

PRACTICALS Total: 27 hrs.

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

1. Students shall be able to prepare artificial key to segregate any five given plants and must be recorded.
2. Students shall submit not less than 15 properly identified herbarium specimens of varying taxa during time of their practical examination.
3. It is compulsory that every student has to undertake a field study tour of not less than 3 days for observing plant diversity under the guidance of teachers of the Department in the 5th semester. Moreover, they have to submit a tour report countersigned by the Head of the department during the practical examination.

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

References

1. Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford & IBH, New Delhi.
2. Sporne, K.R. 1974. Morphology of Angiosperms. Hutchinson University Press London.
3. Radford, A.E. 1986. Fundamentals of plant systematics. Harper & Row Publishers, New York.
4. Nair, 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
VBO5B07: EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY,
ETHNOBOTANY, HORTICULTURE

[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 ($\frac{1}{2}$ 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- Rastogi Publications, '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. Almquist & 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. Ethnobotanic 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 Publications, 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 Acquah, 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

VBO5B08: GENERAL & BIOINFORMATICS, INTRODUCTORY BIOTECHNOLOGY AND MOLECULAR BIOLOGY

[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 access publishing, 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-cistrons, recons and mutons

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|--|--------|
| 4. Genetic code - Characters of genetic code | 3 hrs. |
| 5. Central dogma protein synthesis; Transcription, post-transcriptional modification of RNA, translation; Teminism. | 2 hr. |
| 6. Gene regulation in prokaryotes - operon concept, (Lac operon, trp. operon) | 4 hrs. |
| 7. Gene regulation in eukaryotes (brief account) | 1 hr. |
| 8. Mutation-spontaneous and induced; causes and consequences. Types of mutagens and their effects. Point mutations- molecular mechanism of mutation- Transition, Transversion and substitution | 2 hrs. |
| | 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 micropropagation. 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 analysis; 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 Publishing House, New Delhi.
6. Gupta, P.K. 1996. Elementary Biotechnology. Rastogi & Company, Meerut.
7. Hammond, J., Megary, P *et al.* 2000. Plant Biotechnology. Springer-Verlag.
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.

SIXTH SEMESTER

VBO6B09: GENETICS AND PLANT BREEDING

[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
 5. Population 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.
4. Lewin B. 2000 Genes VII Oxford University Press.
5. Rastogi V.B. 2008, Fundamentals of Molecular Biology, Ane Books, India.
6. Sinnott, 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. [$\frac{3}{4}$ 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

VBO6B10: PLANT PHYSIOLOGY AND METABOLISM

[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 phosphorescence. 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 seismonastic 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. □ 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

1. William G. Llopkins, (1999). Introduction to Plant Physiology, 2nd edition, John Wiley & Sons, Inc.
2. Lincoln Taiz and Eduardo Zeiger (2002). Plant Physiology 2nd edition. Sinauer Associates, Inc. Publishers. Sunderland, Massachusetts
3. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributors.
4. G. Ray Noggle and George J. Fritz Introductory Plant Physiology Prentice Hall.
5. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

VBO6B11: CELL BIOLOGY AND BIOCHEMISTRY

[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 meiotic consequences and significance

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

PRACTICALS [Total: 9 hrs.]

1. Mitosis - Acetocarmine squash preparation of Onion root tip.
2. Calculation of mitotic index
3. Demonstration of meiosis in Rhoeo/Chlorophytum and identification of different stages of Meiosis.

Reference

1. Arumugham. N. Cell Biology. Sara Publication, Nagercoil.
2. Avinash Upadhyaya & Kakoli Upadhyaya 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. Geoffrey M. Cooper & Robert E. Hausman. 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. [1½ 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 quaternary structures of proteins. Native conformation 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
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 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 greenhouse 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). 15hrs.

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. Cunningham W.P. and M.A. Cunningham 2003. Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.
6. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
7. Dix J.H. 1989. Environmental Pollution. Atmosphere, Land, Water and Noise. Wiley Chichester.
8. Khitoliya R.K. 2007. Environmental Pollution – Management and Control for Sustainable development S. Chand and Company Ltd., New Delhi.
9. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.
10. Michael S. 1996. Ecology. Oxford University Press, London.
11. Mishra D.D 2008. Fundamental Concepts in Environmental Studies. S. Chand & Co., New Delhi.
12. Mishra S.P. & S.N. Pandey 2008. Essential Environmental Studies. Ane Books Pvt. Ltd. Thiruvananthapuram.
13. Odum E.P. 1983. Basics of Ecology. Saunders International UN Edition.
14. Shukla R.S. & P.S. Chandel 2005. A Text Book of Plant Ecology S. Chand & Co. Ltd. New Delhi.
15. Wise D.L. 2005. Global Environmental Biotechnology. Ane Books. Trivandrum.
16. Bharucha E. 2005. Text Book of Environmental Studies for UG courses. University Press (India) Private Limited Hyderabad.
17. Archibold. O.W. 1995. Ecology of World Vegetation. Chapman & Hall, London.
18. Diamond, J., T.J. Case 1986. Community ecology. Harper & Row, New York.
19. Futuyma P.J., Slatkin M. 1983. Co-evolution. Sinauer Associates, Sunderland, Mass.
20. Krebs, C.J. 1985. Ecology 3rd edn. Harper & Row New York.
21. Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.

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

ELECTIVE PAPERS

SIXTH SEMESTER

CORE COURSE-11: Elective-1: GENETIC ENGINEERING Code: VBO6E01

[Total: 72hrs. Theory 54 hrs. , Practical: 18 hours]

Module -I

Introduction to gene cloning

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

Module-II

Agarose Gel electrophoresis of DNA and RNA

1. Principles of electrophoresis,
 2. Buffers used for electrophoresis of nucleic acids,
 3. Gel concentration, sample concentration, sample loading solutions,
 4. Gel staining,
 5. Determination of molecular weight using molecular weight markers, special precautions and treatments required for electrophoresis of RNA,
 6. Elution of DNA from agarose gels; electroelution, using low-melting point agarose,
 7. Nucleic acid transfer and hybridization; Southern blot transfer, dot-blot transfer, plaque and colony transfer, Southern blot hybridization, Northern blot transfer and hybridization, in situ hybridization
 8. Preparation of probes for hybridization, radioactive labeling, preparation of primer using PCR, RNA probes
- 15hrs

Module - III

Principle of DNA cloning

1. Cloning vectors; essential features of a cloning vector, plasmid derived vectors , bacteriophage derived vectors, hybrid vectors, high capacity cloning vectors; BACs, PACs and YACs , Agrobacterium based vectors, shuttle vectors, expression vectors
2. Enzymes used in recombinant DNA technology; type II restriction endonucleases, ligases, S1 nuclease, alkaline phosphatase, terminal transferase, DNA polymerase I, reverse transcriptase, exonuclease III, bacteriophages □ exonuclease,
3. Finding gene of interest; shot gun cloning followed by screening, construction and use of genomic DNA library and cDNA library, screening DNA libraries, chromosome walking, in silico gene discovery, cloning of the gene of interest, altering the gene of interest through site directed mutagenesis,
4. Preparation of recombinant DNA molecule, blunt ends and sticky ends, using tailing method, using polylinkers
5. Methods to transfer the recombinant DNA molecule into the cloning host; transformation, transfection, transduction, electroporation, microinjection, microprojectiles and DNA gun, Agrobacterium mediated transfer
6. Methods to select the recombinants; antibiotic markers, insertional inactivation, replica plating, blue-white selection, use of reporter genes; GUS, luciferase and GFP genes
15hrs

Module -IV

Transgenesis; introduction to transgenic organisms and their applications.

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

12 hrs.

Practical: 18 hours

The entire 72 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practicals may be done during theory classes}

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

Protocols of the listed experiments should be recorded.

1. Isolation of genomic DNA from plants and its quantification and purity checking using

- spectrophotometric method
- Agarose gel electrophoresis of the isolated plant genomic DNA, its visualization and photography
 - Record of the practical works done together with the detailed report of the Biotechnology Laboratory visit should be duly certified and submitted for the valuation at the time of practical examination.**

References

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

SIXTH SEMESTER B. Sc. BOTANY DEGREE PROGRAMME
**CORE COURSE-11: ELECTIVE-2: ADVANCED ANGIOSPERM
SYSTEMATICS Code: VBO6E02**

[Total: 72 hrs. Theory: 54 hrs. , Practical: 18 hours]

Module -I Principles of Angiosperm Taxonomy

- Scope and importance of Taxonomy.
- The history of taxonomy- Ancient classification; Evolution of different concepts in taxonomy. The herbalists; Early taxonomists; Linnaeus; Post Linnaean natural systems; Post Darwinian phylogenic; Modern Phenetic methods (Numerical taxonomy); Modern Phylogenic methods (Cladistics). APG system of classification (Brief account only) 12Hrs

Module-II The material basis of Systematics

- Concept of character; Correlation of characters; character weighting; Character variation, isolation and speciation.
- Sources of Taxonomic characters: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Molecular Taxonomy. Role of the above mentioned branches in taxonomic studies
- Identification techniques: Taxonomic literature: Flora, Revision, monograph, use and construction of taxonomic keys. Herbarium: Definition, Steps involved in preparation and maintenance of herbarium, Herbarium consultation; General account of Regional and National herbaria with special emphasis to Kew, CAL, MH, CALI.
- Botanic gardens and their importance in taxonomic studies – Important National and International Botanic Gardens – Royal Botanic Gardens, Kew; Indian Botanic Gardens, Calcutta; National Botanic Garden, Lucknow; Tropical Botanic Garden, Trivandrum; Malabar Botanic Garden, Calicut.
- Digital resources in taxonomy: Softwares, Databases, Online tools; use of TROPICOS, IPINI, Virtual herbaria, Digital flora/databases of Flora of Kerala. 22Hrs

Module – III Plant Nomenclature

1. History of nomenclature – Polynomial and binomial systems
 2. Brief outline of ICBN
 3. Major rules; Typification; Rule of priority; Effective and valid publication; author citation
- 5 hrs

Module – IV Taxonomic review of selected families

Critical study of the following families with emphasis on identification of local members using flora, economic importance, inter relationships and evolutionary trends: Nymphaeaceae, Capparidaceae, Sterculiaceae, Meliaceae, Combretaceae, Lythraceae, Scrophulariaceae, Convolvulaceae, Bignoniaceae, Verbenaceae, Amaranthaceae, Urticaceae, Amaryllidaceae, Arecaceae, Cyperaceae

15 hrs

Practicals: 18 hrs.

{The entire 72 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practical may be done during theory classes}

1. Identification of locally available plants belonging to the families mentioned under module - IV using local floras.
2. Familiarize local flora and study the preparation of taxonomic keys and taxon card for plants coming under the families in module IV.
3. **Students must workout at least one member of the every families mentioned in module IV, and has to make suitable sketches/illustrations manually or digitally, and record the same for valuation at the time of Practical examination as part of submission**

References

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

SIXTH SEMESTER

CORE COURSE-11: Elective-3 GENETICS AND CROP IMPROVEMENT Code: VBO6E03

[Total: 72 hrs. Theory 54 hrs. , Practical: 18 hours]

Module -1.

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

10 hrs

Module –II

1. Plant genetic resources - Definition; Classification of Plant Genetic Resources. Activities –

- exploration, conservation, evaluation, documentation and utilization.
2. Agencies involved in plant genetic resources activities – NBPGR and IPGRI
3. International institutes for crop improvement – IRRI, ICRISAT, CIMMYT, IITA. Brief account on research activities and achievements of national institutes – IARI, CCMB, IISc, BARC, CPCRI, IISR, RRII, CTCRI, KFRI, TBGRI

8 hrs.

Module- III

1. Methods of crop Improvement : a. Plant introduction b. Selection - Principles, Selection of segregating populations, achievements c. Hybridization – Interspecific hybridization; intergeneric – achievements. Genetics of back crossing, Inbreeding, Inbreeding depression, Heterosis and Heterobeltiosis

4 hrs.

Module - IV.

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

7 hrs.

Module- V.

- I. **Breeding for resistance to abiotic stresses** – Introduction, importance of abiotic and biotic stresses and its characteristics.
 - a. **Breeding for drought resistance** – Genetics of drought resistance; Breeding methods and approaches; Difficulties in breeding for drought resistance.
 - b. **Breeding for mineral stress resistance** – Introduction – Salt affected soils – Management of salt affected soils: Salinity resistance – General account – Genetics of salinity resistance – Sources of salinity resistance – Breeding approaches – Problems in breeding for salinity resistance; Mineral stress resistance – General account – Resistance to mineral deficiency stress - Genetics of mineral deficiency resistance – Sources of mineral deficiency resistance.
 - c. **Heat and cold resistance** 1. Heat stress – General account; Heat stress resistance - Genetics of heat tolerance – Sources of heat tolerance. 2. Chilling resistance – Chilling tolerance – Genetics of chilling tolerance – Sources of chilling tolerance; Problems in breeding for freezing tolerance.

15

15 hrs

Breeding for resistance to biotic stresses

1. Disease resistance – History of breeding for disease resistance; Genetics of pathogenicity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance – Oligogenic, polygenic and cytoplasmic inheritance – Sources of disease resistance – Methods of breeding for disease resistance.
 2. Insect resistance – Introduction, Mechanism, Nature and genetics of insect resistance – Oligogenic, Polygenic and cytoplasmic resistance – sources of insect resistance – Breeding methods for insect resistance – Problems in breeding for insect resistance – Achievements – Breeding for resistance to parasitic weeds.
- 10 hrs.

Practicals 18 hrs.

{ The entire 72 hours of Elective paper must be treated as theory hours. Practical hours allotted for Elective courses cannot be considered for calculating work load. Practicals may be done during theory classes }

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

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

References

1. Singh, B D. 2000. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
2. Sharma, J R. 1994. Principles and Practice of Plant Breeding. Tata Mcgraw – Hill Publishing Company, New Delhi.
3. Benjamin Levin. 2007. Genes VIII.
4. Allard, R W. 1960. Principles of Plant Breeding. John Wiley & Sons, New York.
5. Chahal, G S & S S Gosal, 1994. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.
6. Chrispeels M J and Sadava, D E. 1994. Plants, Genes and Agriculture. Jones and Bartlett Publishers, Boston, USA

OPEN COURSE
VBO5D01 : PLANT TISSUE CULTURE

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 propagation.

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

VBO5D02: APPLIED BOTANY

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.
3. Chemical fertilizers: types, application, merits and demerits
4. Organic manure; types, application, merits and demerits
5. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers.
6. Plant protection: Biological, Physical and mechanical, Chemical, biopesticide 12 hrs

Module – III. BOTANY IN EVERY DAY LIFE

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

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, Oushadha Sasyangal (Medicinal plants), State Institute of Language, Kerala, Trivandrum.
15. R. Prakash, Dr. 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.

VBO5D03: GENERAL BOTANY

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. 6Hrs

Module - 2: Morphology of Angiosperms

Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential parts, symmetry. Pollination, seed dispersal of fruits and seeds. 6 hrs.

Module - 3: Anatomy

Definition, general structure, Cell division- mitosis and meiosis, significance, cell cycle. Tissues: simple, compound; structure and functions; Structure and functions of root, stem and leaves. Monocot and Dicot stem- general features; Secondary thickening. Annual rings, heart wood and sap wood. 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, Ecosystems, 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. Ahluwalia V.K. Malhotra S. 2009. Environmental Science. Ane Books – New Delhi.
2. Ambast 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. Cunningham 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.

FIRST SEMESTER :COMPLEMENTARY BOTANY
VBO1C01: ANGIOSPERM ANATOMY AND MICROTECHNIQUE

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

ANGIOSPERM ANATOMY

(Theory: 27 Hours)

Module - I

1. Tissues - Definition, Kinds - Meristematic & Permanent;
 - a. Meristematic tissues - Classification – based on origin & position; Organisation of root apex and differentiation of tissue – Histogen theory; Organisation of stem apex and differentiation of tissues - Tunica & Corpus theory.
 - b. Permanent tissues - Definition - classification;
Simple tissues (Parenchyma, Collenchyma and Sclerenchyma), Complex tissues (Xylem & Phloem)
Secretory tissues - Glandular tissues (Nectaries in Euphorbia pulcherrima, Stinging hairs in Tragia) Oil glands in Citrus, Eucalyptus; Digestive glands in Nepenthes; Laticiferous tissues (Non-articulate latex ducts in Euphorbia and articulate latex duct – latex vessels in Hevea). Hydathodes
2. Vascular bundles – types: conjoint - collateral, bicollateral, concentric and radial. 9 hrs.

Module - II

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

Module - III

1. Normal secondary thickening in dicot stem (Eupatorium and Vernonia)
 - a. Intra stelar thickening: formation of cambial ring, its structure, fusiform and ray initials, storied and non - storied cambium, activity of the cambium, formation and structure of secondary wood, secondary phloem and vascular rays.
 - b. Extra stelar thickening: formation, structure and activity of the phellogen, formation of periderm in stem and root; bark and lenticel.
 - c. Growth rings, ring and diffuse porous wood, sapwood and heart wood, tyloses.
 - d. Normal secondary thickening in dicot root (Tinospora)
2. Anomalous secondary growth in Boerhaavia. 12 hrs.

Practicals - 30 Hours

1. Identity simple and complex tissues and determine the type of vascular bundles using microscope.
2. Make suitable micro preparations to study the anatomy of the following:
 - a. Dicot stem: Cucurbita, Centella (Primary structure);
Eupatorium, Vernonia (secondary structure).
 - b. Monocot stem: grass

- c. Dicot root: Tinospora –young (Pri.), Tinospora – mature (Sec.)
- d. Monocot root: Colocasia/ Musa
- e. Anomalous secondary growth (Boerhaavia).

MICROTECHNIQUE

(Theory: 9 hours)

Module - I

Microtechnique - Brief Introduction

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

Practicals - 6 hrs

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

References: Anatomy

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

References: Microtechnique

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

SECOND SEMESTER : VBO2C02: CRYPTOGRAMS, GYMNOSPERMS & PLANT PATHOLOGY

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

Cryptogams, Gymnosperms & Plant Pathology

Theory: 32hrs.

Module - I

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

Module - II

1. Phycology: General characters, classification, evolutionary trends in algae.
2. Structure, reproduction, life history and economic importance of the following classes with suitable examples:
 - a) Chlorophyceae (Spirogyra)
 - b) Phaeophyceae (Sargassum)
 - c) Rhodophyceae (Polysiphonia). 7 hrs.
3. Mycology: General characters, classification (Alexopoulos, 1979). (brief mention only) and evolutionary trends in fungi.
Important features of the following divisions:
 - a) Mastigomycotina
 - b) Ascomycotina
 - c) Basidiomycotina.
4. Structure and life history of Puccinia (developmental details not required) 4hrs

Module - III

1. Bryology: General account, morphology and life - history of Riccia. 4 hrs.
2. Lichenology: General account and economic importance of Lichens with special reference to Usnea 3hrs
3. Pteridology: General account, morphology and life history of Selaginella 4 hrs.
4. Gymnosperms: General account, morphology and life history of Cycas (Anatomy not required) 4 hrs.

Module - IV

1. Plant Pathology: Study the following plant diseases with special reference to pathogens, symptoms, method of spreading and control measures.
1) Leaf mosaic of Tapioca 2) Citrus canker 3) Blast of paddy 3 hrs.

Practicals: 32hrs.

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

Plant pathology

Practical: 4 hrs.

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

References: Cryptogams

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

References: Gymnosperms

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

References: Plant Pathology

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

THIRD SEMESTER

VBO3C03: MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND HORTICULTURE

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

MORPHOLOGY

Theory: 8 hrs.

Module - I

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

8hrs

Practicals: 4 hrs.

1. Identify the different types of inflorescence included in the syllabus and record the same

4 hrs.

Reference:- Morphology

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

Systematic Botany

Theory; 28 hrs.

Module- I

1. Introduction, scope and importance 1hr.
2. Herbarium techniques: collection, drying, poisoning, mounting & labelling. Significance of herbaria and botanical gardens; Important herbaria and botanical gardens in India. 4 hrs.
3. Nomenclature - Binomial system of nomenclature, basic rules of nomenclature (validity, effectivity and priority), International Code of Botanical Nomenclature. 3 hrs.
4. Systems of classification - Artificial, Natural of Phylogenetic (Brief account only). Bentham & Hooker's system of classification in detail. 5hrs
5. Study the following families: Malvaceae, Fabaceae (with sub-families) Rubiaceae, Apocynaceae, Euphorbiaceae and Poaceae. 15 hrs.

Systematic Botany

Practical: 20hrs.

1. Determine the systematic position of local plants comes under the syllabus based on their vegetative and floral characters
2. Students shall be able to describe the plants in technical terms and draw the L.S. of flower, floral diagrams and the floral formula of two plants belong to each family and record the same.
3. Students are expected to submit five properly identified duly certified herbarium specimens belonging to families included in the syllabus during the practical examination.

References: Systematic Botany

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

Economy Botany [Theory: 4 hrs.]

Module -I

1. Brief account on the various categories of plants based on their economic importance

2. Study the following plants with special reference to their binomial, family, morphology of the useful part and their uses.
 1. Cereals - Paddy, Wheat
 2. Pulses - Black gram, Green gram
 3. Oil - Coconut, Gingelly
 4. Fibre - Cotton
 5. Latex - Rubber
 6. Beverages - Tea, Coffee
 7. Spices - Pepper, Cardamom, Clove
 8. Medicinal plants – *Rauvolfia serpentina*, *Justicia adhatoda*,

Santalum album and *Curcuma longifolia*.

Practical: 4 hrs.

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

References: Economic Botany

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

Plant Breeding Theory: 7hrs.

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

Practical: 4 hrs.

1. Demonstration of hybridization technique

References: Plant Breeding

1. Allard. R.W. 1960. Principles of Plant breeding, John Wiley & Sons, Inc, New York.
2. Singh, B.D. 2005. Plant Breeding - Principles & methods , Kalyani Publishers, New Delhi.
3. Chaudhari. H.K. Elementary Principles of Plant breeding, Oxford & IBH Publishers.

Horticulture [Theory: 7 hrs.]

1. Horticulture- introduction: definition, branches, significance



2. Methods of plant propagation:
 - a. Seed propagation – Seed germination (Epigeal & Hypogeal)
 - b. Vegetative propagation
 1. Cutting – stem, root, leaf
 2. Layering –air layering
 3. Grafting: Approach grafting, Tongue grafting
 4. Budding: Patch and T-budding

Practical: 4 hrs.

1. Demonstration of layering, grafting and budding

References:- Horticulture

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

FOURTH SEMESTER

VBO4C04:PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

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

PLANT PHYSIOLOGY

[Theory: 36 hours]

Module - I

1. Structure of plant cell and cell organelles (Brief account only)
2. Water relations - Permeability, Imbibition, Diffusion, Osmosis and water potential
3. Absorption of water- Active and passive mechanisms
4. Ascent of sap -Root pressure theory, Transpiration pull or cohesion-tension theory.
5. Transpiration -Types, mechanism of stomatal movement: K^+ ion theory, significance of transpiration, antitranspirants. 12 hrs

Module - II

1. Photosynthesis-Introduction, significance, Two pigment systems, red drop, Emerson enhancement effect, action and absorption spectra. Mechanism of photosynthesis - Light reaction, cyclic & non-cyclic photo phosphorylation, Dark reactions–Calvin cycle, C_4 cycle, photorespiration (a brief account only). Factors affecting photosynthesis.
2. Respiration-Definition, Kinds of respiration-aerobic and anaerobic; Glycolysis, Krebs cycle, Terminal oxidation, Fermentation 24 hrs

Practicals - 18 hours

Learn the principle and working of the following apparatus/experiments

1. Ganong's potometer
2. Ganong's light-screen
3. Absorption transpirometer
4. Kuhne's fermentation vessel
5. Mohl's half-leaf experiment
6. Experiment to demonstrate suction due to transpiration
7. Experiment to show evolution of O_2 during photosynthesis

References:

1. William G. Llopkins, (1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.
2. Frank B. Salisbury and Cleon W. Ross (2002). Plant Physiology 3rd edition. CBS publishers and distributors.
3. G. Ray Noggle and George J. Fritz Introductory Plant Physiology Prentice Hall.
4. Goodwin Y.W., and Mercer E.I. (2003) Introduction to Plant Biochemistry. 2nd edition. CBS Publishers and distributors.

PLANT ECOLOGY

[Theory: 9 hours]

Module - I

1. Ecology-Definition, Ecosystem: ecological factors –biotic and abiotic. 2 hrs.
2. Ecological adaptations: Morphological, anatomical and physiological adaptations of the following types: Hydrophyte (Vallisneria, Hydrilla), Xerophyte (Opuntia, Nerium), Halophyte (Avicennia), Epiphytes (Vanda) and parasites (Cuscuta). 4 hrs
Ecological succession –Process of succession, types of succession, Hydrosere 3hrs

Practicals

Total: 9 hrs.

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

References:

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

GENETICS Theory: 9hrs.

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

Practical 9 hrs.

1. Students are expected to work out problems related to Monohybrid, Dihybrid,

Test cross, Incomplete dominance and has to be recorded.

References: - Genetics

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

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIRST SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 2016

(CBCSS-UG)

Core Course-Botany

VBO1B01- ANGIOSPERM ANATOMY

Time : 3 Hours

Maximum Marks: 80

Part A

*Answer **all** questions.*

Each question carries 1 mark.

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

(1x10=10marks)

Part B

*Answer **all** questions.*

Each question carries 2 marks.

11. Differentiate between simple and compound leaves
12. Comment on Endodermis
13. What are tyloses? Mention their function.
14. What are annual rings?



15. Comment on boarded pits.
16. What is Histogen theory?
17. What are Hydathodes?
18. What is meant by leaf gaps?
19. Define a Concentric bundle.
20. What is protoxylem lacuna?

(2x10=20 marks)

Part C

Answer **six** questions.

Each question carries 5 marks.

21. With a labelled sketch explain the structure of an isobilateral leaf.
22. What are lenticels? Mention their functions.
23. What is heart wood?
24. Describe root-stem transition in plants.
25. Differentiate between Schizogenous and lysigenous ducts.
26. Describe the various types of stomata with examples.
27. Describe the structure of Xylem and phloem.
28. Comment on extra cell wall materials.

(6x5 = 30 marks)

Part D

Answer any **two** questions.

Each question carries 10 marks.

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

2x10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Botany VBO2B02–

RESEARCH METHODOLOGY & MICROTÉCHNIQUE

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

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

10. Concentration of Commercial formalin is -----

(10 x 1= 10marks)

Part B

Answer **all** questions.

Each question carries 2 marks.

11. Write short note on bar diagram
12. What is double staining?
13. What are the advantages of arithmetic mean over median
14. Significance of sampling in a population.
15. Significance of range in measuring the variability
16. What is maceration?
17. Explain the role of ethyl alcohol in permanent slide preparation
18. Write a note on significance of staining.
19. Frequency polygon
20. Random sampling

(10x 2 = 20 marks)

Part C

Answer any **six** questions.

Each question carries 5 marks.

21. Explain the preparation of one molar solution of HCl

22. What is the principle involved in centrifugation
23. Describe Poisson distribution
24. What is the significance of random number table.
25. Calibration in microscopic measurement
26. Common killing and fixation fluids.
27. Give an account on the working of pH meter
28. Write down the mechanism of camera lucida

(6x 5 = 30marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

29. Write an essay on different kinds of design of experiments.
30. Explain the principle, working, types and advantages of Electron Microscope.
31. Write an essay on the conditions to be observed while writing a research report.

(2 x 10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

THIRD SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Botany

VBO3B03- MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. A virion is -----
2. Lichen grown on the trees are called
3. Quick wilt of Pepper is caused by
4. Apothecium is the fruit body of -----
5. Asexual reproductive structure in Lichen is -----
6. Give an example of SCP.
7. What is chlorosis?
8. An example for Nitrifying Bacteria
9. Name a heteroecious fungus.
10. What is karyogamy?

(10 x 1= 10marks)

Part B

Answer all questions.

Each question carries 2 marks.

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

(10x 2 = 20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5 marks.

21. Write a brief account of the features of ascomycetes.
22. Give a brief account of structure of HIV.
23. Enumerate the economic importance of Fungi.
24. Briefly explain physiology of parasitism.
25. Briefly explain the vegetative reproduction in lichens.
26. Describe the transduction in bacteria.
27. Briefly explain the structure of different spores produced by Puccinia.
28. List the general characteristics of Deuteromycetes.

(6x 5 = 30marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

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

(2 x 10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FOURTH SEMESTER B.Sc DEGREE EXAMINATION, MARCH 20--

(CBCSS-UG)

Core Course-Botany

VBO4B04- PHYCOLOGY, BRYOLOGY, PTERIDOLOGY

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. is a marine alga.
2. is an example for vascular cryptogam.
3. is the type of stele of *Pteris* Rhizome.
4. is male sex organ in *Chara*.
5. Floridean Starch is the energy reservoir of the Class of algae -----
6. Sporangium develops from a single initial cell is called -----
7. *Anthoceros* is commonly known as -----
8. Name a plant with Polystelic stem -----
9. is the most primitive type of thallus in Algae.
10. ----- is an most economically important bryophyte.

(10 x 1= 10marks)

Part B

Answer all questions.

Each question carries 2 marks.

11. Define Plakea.
12. What is Nannandrium?
13. Explain Stele in *Marsilea* rhizome.
14. What is a Ligule?
15. What is Zygosporangium?
16. Define Apospory. Give an example.
17. Explain the spore dispersal mechanism in *Funaria*.
18. What are resurrection plants? Give example.
19. List the primitive characters of *Riccia* sporophyte.
20. What are the types of pigments in Phaeophyceae?

(10x 2 = 20 marks)

Part C

Answer any **six** questions.

Each question carries 5 marks.

21. Enumerate the medicinal uses of algae.
22. Compare the elaters of *Equisetum* and *Anthoceros*.
23. Write an account on economic Importance of Bryophytes.
24. Explain the sexual reproduction in *Volvox*.
25. Draw L.S. of *Selaginella* strobilus, label the parts and describe its structure.
26. Briefly explain the affinities of Pteridophytes with Bryophytes and Gymnosperms.
27. "Heterospory is the beginning of seed habit". Discuss.
28. Give the general characters of Xanthophyceae

(6x 5 = 30marks)

Part D

Answer any **two** questions.

Each question carries 10 marks.

29. Explain any two life cycles you have studied in algae with examples.
30. Discuss the evolution of sporophytes in Bryophyta with the help of suitable examples
31. With necessary diagrams describe the stelar evolution in Pteridophytes.

(2 x 10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 20--

(CBCSS-UG)

Core Course-Botany

VBO5B05- GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY &

EVOLUTION

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

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

(10x1=10marks)

Part B

Answer **all** questions.

Each question carries 2 marks.

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

(10x2=20 marks)

Part C

Answer any **six** questions.

Each question carries 5 marks.

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

(6x5= 30marks)

Part D

Answer any **two** questions.

Each question carries 10 marks.

29. With the help of neat labelled diagrams discuss the similarities and differences of the Gymnosperm ovules you have studied and add a note on their evolutionary trend.
30. Describe the various patterns of plant distribution.
31. Write an essay on the evidences of organic evolution.

(2x10= 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 2016

(CBCSS-UG)

VBO5B06--ANGIOSPERM MORPHOLOGY AND PLANT SYSTEMATICS

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. Who is the father of Botany
2. Standard size of herbarium sheet
3. Binomials with identical generic and specific names is called -----
4. Verticillaster inflorescence is found in -----
5. The abbreviation of OTU stands for
6. Caryopsis is the fruit seen in the family
7. Inflorescence in sunflower is -----
8. Classification based on chemicals present in the taxon is -----
9. *Tridax* shows ----- stem.
10. What is holotype?

(10 x 1= 10marks)

Part B

Answer all questions.

Each question carries 2 marks.

11. What are root buttresses?
12. What is a Flora?
13. What is epigyny?
14. Write the salient features for Apocyanaceae

15. Mention the inflorescence of Asteraceae
16. What is meant by Binomial nomenclature?
17. Distinguish between aggregate fruit and multiple fruit.
18. Describe coenanthium inflorescence.
19. Give the differences between indented key and bracketed key.
20. Give the floral features of Poaceae.

(10x 2 = 20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5 marks.

21. Briefly describe taxonomic hierarchy
22. Briefly describe chemotaxonomy
23. Describe the diagnostic features of the family Lamiaceae
24. Mention the family, binomial and useful part of any three cereals.
25. Mention the family, binomial and useful part of gum Arabic, and Asafoetida.
26. Give the morphology of tendrils in Cucurbitaceae.
27. Draw the floral diagram and give the floral formula of a flower in Rubiaceae.
28. Describe adnation in Solanaceae.

(6x 5 = 30marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

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

(2 x 10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 20..

(CBCSS-UG)

Core Course-Botany

VBO5B07- EMBRYOLOGY, PALYNOLOGY, ECONOMIC BOTANY, ETHNOBOTANY AND HORTICULTURE

Time: 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. Name the anther wall layer with fibrous thickening.
2. Define ethnobotany.
3. What is pollinium?
4. Name a nematode used in vermin composting
5. Olericulture deals with the study of.....
6. Name the type of ovule in which the funiculus surrounds the ovule.
7. Cotyledon of Monocot embryo is known as
8. Monotheous anthers are found in
9. Name a fern used as biofertilizer.
10. Name the binomial of clove.

(10x1=10 marks)

Part B

Answer all questions.

Each question carries 2 marks.

11. Name any two fibre yielding plant and their binomial
12. What are clones?



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

(10x2=20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5 marks.

21. Name any two fruit yielding plants, binomials and their families.
22. Comment on the role of Palynology in Taxonomy.
23. Describe the methods of Pollen viability tests.
24. Comment on the causes and significance of Polyembryony.
25. Give an account on indoor gardening.
26. List out the scope of Horticulture.
27. Describe different types of endosperm formation found among
28. Briefly describe South Indian Tribes.

(6x5=30 marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

29. Write an essay on methods of propagation in plants
30. Write an essay on Mushroom cultivation
31. With the help of diagrams describe the Cruciferad type of embryo development in angiosperms.

(2x10=20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 20--

(CBCSS-UG)

Core Course-Botany

VBO5B08- GENERAL AND BIOINFORMATICS, INTRODUCTORY
BIOTECHNOLOGY & MOLECULAR BIOLOGY

Time : 3 Hours

Maximum Marks: 80

Part A

Answer **all** questions

Each question carries 1 mark

1. culture is used for the production of virus free plants.
2. is the basic principle of plant tissue culture.
3. An instrument used for the sterilization is -----
4. An ----- is used for initiation of the plant tissue culture
5. DNA is known as left handed DNA.
6. Unit of function is known as -----
7. An enzyme responsible for Teminism is -----
8. GenBank is a ----- sequence database.
9. ----- is a multiple sequence alignment tool. .
10. A commonly used search engine is -----

(1x10=10marks)

Part B

Answer **all** questions.

Each question carries 2 marks.

11. Mention the significance of anther culture.
12. Differentiate between inoculation and incubation.
13. What is cell immobilization?
14. What is organogenesis?
15. What is one gene one enzyme hypothesis?
16. What is Hershey Chase experiment?
17. What is tRNA? Mention its function.
18. What is proteomics?
19. What is PDB?
20. What is virtual reality?

(2x10=20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5marks.

21. What are synthetic seeds? List the advantages of synthetic seeds.
22. Explain the procedure involved in somatic hybridization.
23. What is micropropagation? List the advantages and disadvantages.
24. Explain the semi conservative method of replication of DNA.
25. List the properties of genetic code.
26. What is an operon? With an example briefly explain the operon concept.
27. Briefly explain IT application in education.
28. List the salient features of human genome project.

(6x5 = 30 marks)

Part D

*Answer any **two** of the following.*

Each question carries 10 marks.

29. Explain the various constituents and role of different components in tissue culture medium.
30. Briefly describe the post transcriptional modifications of RNA
31. What is mutation? Give an account of molecular mechanism of mutation.

(2x10 = 20 marks)



VIMALA COLLEGE
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Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION, MARCH 20..

(CBCSS-UG)

Core Course-Botany

VBO6B09-GENETICS & PLANT BREEDING

Time: 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. What are alleles?
2. Define genotype.
3. Who discovered incomplete dominance in *Mirabilis*?
4. If the father is of A group and the mother is of O group, the child will be..... group.
5. Give an example of an intergeneric cross
6. CPCRI is involved in improvement of ----- crops
7. Dihybrid Testcross ratio is -----
8. Complementary interaction in Sweet Peas gives an F₂ ratio -----
9. The F₂ ratio of recessive epistasis is -----
10. Father of green revolution in India is -----

(10x1=10 marks)

Part B

Answer all questions.

Each question carries 2 marks.

11. What is vertical resistance?
12. Mention any 2 differences between mass selection and pure line selection.
13. What is plant introduction?
14. What are lethal genes? Give an example.
15. What are holandric genes?
16. Differentiate between codominance and incomplete dominance.
17. Explain the complementary gene action.
18. Define heterosis.
19. State Hardey - Weinberg Law.
20. What are multiple alleles?

(10x2=20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5 marks.

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

(6x5=30 marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

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

(2x10=20 Marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION, MARCH 20....

(CBCSS-UG)

Core Course-Botany

VBO6B10- PLANT PHYSIOLOGY AND METABOLISM

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

1. ATP and -----assimilatory powers in photosynthesis.
2. The universal currency of free energy in biological systems is -----
3. plant shows seismonastic movement
4. Fatty acid biosynthesis in germinating seeds takes place in -----
5. is a method of breaking dormancy
6. is the first enzyme involved in glycolysis.
7. is the hormone involved in stomatal closure.
8. is a floral hormone.
9. is removed during each cycle of β -oxidation of fatty acids.
10. -----is a macronutrient.

(10x1=10 marks)

Part B

Answer *all* questions.

Each question carries 2 marks.

11. What is cohesion?
12. Define chlorosis.
13. Define tropism.
14. Define intermediary metabolism.
15. Mention the significance of glyoxylate cycle.
16. What is nutation?
17. Name two electron carriers in Photosynthesis.
18. Name the stimulus in thigmotropism.
19. What is meant by synergistic action?
20. What is α -oxidation?

(10x2=20 marks)

Part C

Answer any *six* questions.

Each question carries 5 marks.

21. Explain the mechanism of guard cell movement.
22. Enumerate the physiological roles of auxin.
23. What are the components of water potential?
24. Describe the glycolytic pathway with the help of a diagrammatic representation.

25. How does biosynthesis of fatty acids take place in plants?
26. Give an account of chemiosmotic hypothesis.
27. Give an account of the amphibolic nature of citric acid cycle.
28. Describe cohesion-tension theory. Give its merits and demerits.

(6x5=30 marks)

Part D

Answer any **two** questions.

Each question carries 10 marks.

29. Trace the path of electrons from water to NADP^+ during photosynthetic electron transport.
30. Briefly describe the process of oxidative phosphorylation in plants.
31. Describe the process of root nodule formation in leguminous plants and the biochemistry of N_2 fixation Explain the different levels of architecture of proteins.

(2x10=20 Marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B. Sc DEGREE EXAMINATION, MARCH 20--

(CBCSS-UG)

Core Course-Botany

VBO6B11- CELL BIOLOGY & BIOCHEMISTRY

Time : 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

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

(10 x 1= 10marks)

Part B

Answer **all** questions.

Each question carries 2 marks.

11. What is zwitterion?
12. Mention the features of nucleosomes.
13. What is aldose?
14. What are isoenzymes? Give an example.
15. What are the functions of vacuoles?
16. Differentiate between purines and pyrimidines.
17. Mention any two characteristic features of Fluid-Mosaic Model.
18. Write any two applications of steroids.
19. Describe the different components of Golgi complex.
20. Mention any two functions of nucleolus?

(10x 2 = 20 marks)

Part C

Answer any **six** questions.

Each question carries 5 marks.

21. Explain the structure and functions of an organelle associated with photosynthesis.
22. Describe the morphology and ultra structure of chromosomes.
23. What is cytoskeleton? Explain the function of cytoskeleton.
24. Differentiate between furanose and pyranose forms of sugars.

25. Explain the tertiary structure of proteins.
26. Give an account of polyploidy and their role in plant breeding.
27. Explain the structure and functions of phospholipids.
28. What are coenzymes? Give an example.

(6x 5 = 30marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

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

(2 x 10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION, MARCH 20....

(CBCSS-UG)

Core Course-Botany

VBO6B12- ENVIRONMENTAL SCIENCE

Time: 3 Hours

Maximum Marks: 80

Part A

Answer all questions.

Each question carries 1 mark.

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

(10x1=10 marks)

Part B

Answer all questions.

Each question carries 2 marks.

11. Define trophic level.
12. What is pneumatophore?
13. What happens if ozone gets depleted?
14. Comment on the ecological pyramids.
15. What is keystone species?
16. What are meant by dominance of species?
17. What are e-wastes?
18. Explain ex situ conservation.
19. What is biomagnification?
20. What is a quadrat method?

(10x2=20 marks)

Part C

*Answer any **six** questions.*

Each question carries 5 marks.

21. What is species diversity? Compare α , β , and γ diversities.
22. Comment on the abiotic factors in an ecosystem.
23. Discuss the role of various international organizations on environment protection.
24. Comment on Xerosere.
25. How will you prepare species area curve?
26. Explain the strategy for solid waste management.
27. Give an account on KSBDB.
28. Describe forest as an ecosystem.

(6x5=30 marks)

Part D

*Answer any **two** questions.*

Each question carries 10 marks.

29. Define biodiversity. Explain the various means of conservation of biodiversity.
30. What is Plant succession? Explain the various stages involved in hydrosere.
31. Give an account of Global environmental changes.

(2x10=20 Marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
SIXTH SEMESTER B.Sc DEGREE EXAMINATION, MARCH 20--
(CBCSS-UG)
Core Course Elective –Botany
VBO6E01 - GENETIC ENGINEERING

Time:3 Hours

Maximum Marks: 80

Part A

Answer *all* questions.

Each question carries 1 mark.

1. PCR
2. Marker
3. Probe
4. Replica plating
5. Dot-blot
6. BACs
7. Polylinkers
8. Ligases
9. Electroelution
10. Gene

(10x1=10 marks)

Part B

Answer *all* questions.

Each question carries 2 marks.

11. Chromosome walking
12. Uses of reporter genes
13. Methods for breaking the cells
14. RNase inhibitors
15. Luciferase and GFP genes
16. Gene targeting
17. Shuttle vectors

18. RNAi technology
19. Shot gun cloning
20. DNA ligation

(10x2=20 marks)

Part C

*Answer any **six** questions.
Each question carries 5 marks.*

21. How to concentrate the isolated DNA
22. What is knock out models? What are the uses?
23. Explain CTAB method
24. What is a Vector? Essential features of a cloning vector?
25. Explain Agrobacterium mediated gene transfer method in plants.
26. Write a short note on Genomic DNA library
27. What is a transgenic plant? List the names of any 4 transgenic plants
28. Describe various enzymes used in recombinant DNA technology

(6x5=30 marks)

Part D

*Answer any **two** questions.
Each question carries 10 marks.*

29. Methods to transfer the recombinant DNA molecule into the cloning host
30. Agarose Gell electrophoresis of DNA.
31. Protocol of plant genomic DNA isolation

(2x10=20 Marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIRST SEMESTER B.Sc DEGREE EXAMINATION, OCTOBER 2016

(CBCSS-UG)

Complementary Course-Botany

VBO1C01-ANGIOSPERM ANATOMY & MICROTECHNIQUE

Time: 3 Hours

Maximum: 64 marks

Part A

Answer *all* questions.

Each question carries 1 mark.

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



(1x10=10marks)

Part B

Answer any **seven** questions.

Each question carries 2 marks.

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

(7x12=14 marks)

Part C

Answer **six** questions.

Each question carries 4 marks.

21. What is meristem? Classify them based on position, origin and function.
22. With suitable labelled diagrams, describe the primary structure of a dicot stem.
23. Explain the extra stelar secondary growth in stem.
24. Give a detailed account of isobilateral leaf with the help of labelled sketch.

25. Briefly describe the mechanism of electron microscope
26. Important anatomical characters of Dicot root
27. Comment on Sap wood and heart wood
28. Distinguish between ring porous wood and diffuse porous wood

(6x4 = 24 marks)

Part D

Answer any **two** questions.

Each question carries 8 marks.

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

(2x8 = 16 marks)



Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Complementary Course-Botany

VBO2C02-CRYPTOGRAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Time: 3hrs

Max. 64 marks

Part A

Answer **all** questions.

Each question carries 1 mark.

Each question carries 1 mark.

1. Nucleus of Nostoc is -----
2. is an example for Gram-negative bacteria
3. is the pathogen responsible for Blast of paddy
4. Cell wall of Bacteria is made up of -----
5. are non vascular embryophytes
6. Viroids are -----
7. Fruiting body of Usnea is -----
8. Whittaker placed Bacteria in the Kingdom -----
9. discovered Virus
10. Heterospory is seen in -----

(1 x 10 = 10 marks)

Part B

Answer any **seven** questions.

Each question carries 2 marks.

11. Describe rhizoids in Riccia
12. What is heterospory?
13. What are heterocysts?
14. Give the expansion of AIDS & HIV
15. Account on shoots in Pinus
16. What do you mean by heteroecious fungi?
17. Pigments in Algae
18. Biological control
19. Cystocarp in Polysiphonia
20. Symptoms of the Blast of paddy (7 x 2 = 14 marks)

Part C

Answer **six** questions.

Each question carries 4 marks.

21. Explain the morphology of rhizophore in Selaginella
22. List out different methods of disease control
23. Describe the structure of Riccia sporophyte.
24. Draw a neat labeled diagram of Bacteria
25. Distinguish between Cryptostomata and Conceptacle

26. Describe the receptacle of Sargassum
27. Describe the structure of a Bacteriophage
28. Give an account on the reproduction in Lichens (6 x 4=24 marks)

Part D

Answer any **two** questions.

Each question carries 8 marks.

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

(2 x 8 = 16 marks)



Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

THIRD SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Complementary Course-Botany

VBO3C03 - MORPHOLOGY, SYSTEMATIC, BOTANY, ECONOMIC BOTANY,

PLANT BREEDING AND HORTICULTURE

Time: 3hrs

Max. 64 marks

Part A

Answer **all** questions.

Each question carries 1 mark.

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

(1x10=10 marks)

Part B

Answer any **seven** questions.

Each question carries 2 marks.

11. Define phyllotaxy. Mention different types.
12. Chemicals used to protect herbarium sheets.
13. Why grafting is not successful in monocots?
14. Name the alkaloids extracted from *Rauvolfia*.
15. Draw the floral diagram of Fabideae
16. Principles of ICBN
17. Describe the spikelet in Poaceae
18. Comment on the morphology of angiosperm flower
19. Give the binomial, Family and useful part of cotton and rubber
20. Define T-budding (2 x 7 = 14 marks)

Part C

Answer **six** questions.

Each question carries 4 marks

21. Mass selection and Pureline selection
22. Organization of ICAR
23. What is the importance of Quarantine in plant breeding technique?
24. What is meant by Doctrine of signature? Explain it by giving suitable examples.
25. Describe the characters of the family Rubiaceae

26. What is placentation? Write different types.
27. Describe Resistance breeding
28. Describe different methods of vegetative propagation

(6x4=24 marks)

Part D

*Answer any **two** questions.*

Each question carries 8 marks.

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

(2x8=16 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FOURTH SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Complementary Course-Botany

VBO4C04 - PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

Time: 3 Hours

Maximum: 64 marks

Part A

*Answer **all** questions.*

Each question carries 1 mark.

1. Name the Father of Genetics
2. ----- is a Xerophyte
3. Name the enzyme which fixes CO₂ in C₃ plants
4. Wilting of plants occurs when -----tissue is removed.
5. The cohesion tension theory regarding ascent of sap was given by -----
6. Incomplete dominance is reported by-----
7. The oxidation of NADH₂ yields ----- number of ATP
8. Give an example of inter genic interaction
9. Ethylene gas is used for -----
10. Site of glycolysis is -----

(1x10=10marks)

Part B

Answer any **seven** questions.

Each question carries 2 marks.

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

(7x12=14 marks)

Part C

Answer **six** questions.

Each question carries 4 marks.

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

(6x4 = 24 marks)

Part D

Answer any **two** questions.

Each question carries 8 marks.

29. Discuss the mechanism and significance of Hatch and Slack pathway in Photosynthesis.
30. Describe the steps of citric acid cycle.
31. What is plant succession? Describe Hydrosere

(2x8 = 16 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Open Course-Botany
VBO5D01 - PLANT TISSUE CULTURE

Time:2 Hours

Maximum Marks: 40

Part A

Answer all questions.

Each question carries 1 mark.

- 1 is the principle behind Plant tissue Culture
2. is a surface sterilising agent.
3. Virus free plants are obtained through.....culture
4. pH of MS Medium is

(1x4=4marks)

Part B

*Answer any **five** questions.*

Each question carries 2 marks.

5. What is meant by Hardening ?
6. Explain Flame sterilization.
7. Differentiate between redifferentiation and dedifferentiation.
8. What is an autoclave?
9. What is organogenesis?
10. Define somatic embryo.

(2x5=10 marks)

Part C

*Answer any **four** questions.*

Each question carries 4 marks.

11. List the merits and demerits of pollen culture.
12. Explain synseeds. How are they prepared?
13. List the basic components of Plant Tissue culture medium.
14. What is somaclonal variation?
15. What are the applications of embryo culture?
16. What are the main objectives of Plant Tissue Culture?

(4x4 = 16marks)

Part D

*Answer any **one** question.*

Each question carries 10 marks.

17. Explain the applications of Plant Tissue Culture.
18. What is Micropropagation? Explain the procedure and mention its advantages and disadvantages.

(1x10 = 10 marks)