



COMPLEMENTARY COURSE IN BOTANY

FOR BSC ZOOLOGY

**(CHOICE BASED CREDIT AND SEMESTER SYSTEM FOR
UNDERGRADUATE CURRICULUM)**

UNDER THE FACULTY OF SCIENCE

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019 – '20 ONWARDS)

BOARD OF STUDIES IN BOTANY (UG)

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA - 680125, KERALA, INDIA

JUNE, 2019

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA
MEMBERS OF BOARD OF STUDIES IN BOTANY

1. Dr. Tessy Paul P. (Chairperson)

Associate Professor & HOD, Department of Botany,
Christ College (Autonomous), Irinjalakuda, Thrissur - 680125

2. Dr. Ignatius Antony (University Nominee)

Principal & Associate Professor, Department of Botany,
St. Thomas College (Autonomous), Thrissur – 680 121

3. Dr. Fr. Jose John, CMI

Vice Principal & Assistant Professor, Dept. of Botany,
Sacred Heart College (Autonomous), Thevara, Ernakulum – 682 013

4. Dr. Lizzy Mathew

Associate Professor & HOD, Dept. of Botany,
St. Teresa's College (Autonomous), Ernakulam – 682 011

5. Dr. P.A. Jose

Principal Scientist & HOD, Dept. of Tree Physiology,
Forest Ecology & Biodiversity Conservation Division, Kerala Forest Research Institute, Peechi

6. Dr. N.S. Magesh

Project Scientist 'B',
National Centre for Antarctic and Ocean Research (NCAOR),
Ministry of Earth Sciences, Government of India, Headland Sada, Vasco-da-Gama, Goa - 403 804

7. Prof. E.J. Vincent

Associate Professor (Retd.) & Coordinator, Dept. of Botany (Self),
Christ College (Autonomous), Irinjalakuda, Thrissur - 680125

8. Dr. C.J. Mani

Associate Professor (Retd.) & Faculty Member, Dept. of Botany (Self),
Christ College (Autonomous), Irinjalakuda, Thrissur - 680125

9. Prof. Jacob Abraham Pulikkal

Associate Professor (Retd.) & Faculty Member, Dept. of Botany (Self),
Christ College (Autonomous), Irinjalakuda, Thrissur – 680125

10. Ms. Sabeena A.M.

Faculty Member, Dept. of Botany (Self),
Christ College (Autonomous), Irinjalakuda, Thrissur - 680125

11. Ms. Sweety M.S.

Faculty Member, Dept. of Botany (Self),
Christ College (Autonomous), Irinjalakuda, Thrissur – 680125

12. Ms. Sreelakshmi V.V.

Faculty Member, Dept. of Botany (Self),

Christ College (Autonomous), Irinjalakuda, Thrissur – 680125

Table 1. COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours allotted /Week	Credit
S I	BOT1C01T	COMPLEMENTARY COURSE 1. Angiosperm Anatomy & Microtechnique	36 hrs	2	2
	-	Complementary Course -1 Practical	36 hrs	2	*
S II	BOT2C02T	COMPLEMENTARY COURSE 2. Cryptogams, Gymnosperms & Plant Pathology	36 hrs	2	2
	-	Complementary Course –2 Practical	36 hrs	2	*
S III	BOT3C03T	COMPLEMENTARY COURSE - 3 Morphology, Systematic Botany, Economic Botany, Plant Breeding & Horticulture	54 hrs	3	2
	-	Complementary Course-3 Practical	36 hrs	2	*
S IV	BOT4C04T	COMPLEMENTARY COURSE - 4 Plant Physiology, Ecology & Genetics	54 hrs	3	2
	-	Complementary Course - 4 Practical	36 hrs	2	*
	BOT4C05P	COMPLEMENTARY COURSE- 5 Practical Paper 1 - Angiosperm Anatomy, Microtechnique, Cryptogams, Gymnosperms, Plant Pathology, Morphology, Systematic Botany, Plant Physiology, Ecology, Genetics, Economic Botany, Plant Breeding & Horticulture			4
TOTAL					12
* Credits of practical paper (Total credits provided against Practical paper BOT4C05 P)					

Table 2. COURSE STRUCTURE, MARK DISTRIBUTION, SCHEME OF EXAMINATION

Course code&Title of course	Total Hours		Duration of Exams	Marks			
	Theory	Pract ical		Theory		Practical	
				External	Internal	External	Internal

Semester -1 : BOT1C01T Anatomy & Microtechnique	36	36	2 hrs	60	15	--	--
Semester-2 : BOT2C02 T Cryptogams, Gymnosperms & Plant Pathology	36	36	2 hrs	60	15	--	--
Semester-3: BOT3C03T Morphology, Syst. Botany, Economic Botany, Plant Breeding & Horticulture	54	36	2 hrs	60	15	--	--
Semester- 4: BOT4C04T Plant Physiology, Ecology & Genetics	54	36	2 hrs	60	15	--	--
Semester- 4: BOT4C05P Comple. Course Practical External Practical Exam Record Submission	--	--	3 hrs	--	--	60 15 10	15

Table 3. DISTRIBUTION OF INTERNAL MARKS

Theory : Marks 15 (20% of total)		Practical : Marks 15 (20% of total)	
Components	Percentage	Components	Percentage
Test paper	40%	Record	60%
Assignment	20%,	Lab involvement	40%
Seminar	20%		
Class room participation based on attendance	20%.		

Table-4: SPLIT UP OF MARKS FOR TEST PAPER

Range of Marks in test paper	Out of 6 (Maximum internal marks 15)
Less than 35%	1
35% - 45%	2
45% - 55%	3
55% - 65%	4
65% -85%	5
85% -100%	6

Table-5: SPLIT UP OF MARKS FOR CLASS ROOM PARTICIPATION

Range of CRP	Out of 3 (Maximum internal marks 15)
$50\% \leq \text{CRP} < 75\%$	1
$75\% \leq \text{CRP} < 85\%$	2
85 % and above	3

QUESTION PAPER PATTERNS**QUESTION PAPER TYPE****Scheme of Examinations:**

The external QP with 60 marks and internal examination is of 15 marks. Duration of each external examination is 2 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A & B. But there shall be Ceiling in each section.

Section A: Short answer type carries 2 marks each - 12 questions - Ceiling - 20

Section B: Paragraph type carries 5 marks each - 7 questions - Ceiling - 30

Section C: Essay type carries 10 marks (1 out of 2) - $1 \times 10 = 10$ Marks

METHOD OF INDIRECT GRADING

Evaluation (both internal and external) is carried out using Mark system. The Grade on the basis of total internal and external marks will be indicated for each course, for each semester and for the entire programme. Indirect Grading System in 10-point scale is as below:

Table-6: TEN POINT INDIRECT GRADING SYSTEM

Percentage of Marks (Both Internal & External put together)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
95 and above	O	Outstanding	10	9.5 - 10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 - 9.49	
75 to below 85	A	Very good	8	7.5 - 8.49	
65 to below 75	B+	Good	7	6.5 - 7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 - 6.49	
45 to below 55	C	Average	5	4.5 - 5.49	Second Class
35 to below 45	P	Pass	4	3.5 - 4.49	Third Class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

SEMESTER 1

BOT1C01T - ANGIOSPERM ANATOMY AND MICROTECHNIQUE

Contact Hours per Week: 4

Number of Credits: 2

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Course Outline

DISTRIBUTION OF TEACHING HOURS (18 hrs/Semester = 1hr/week)

Sl. No	Subject	Theory	Practical	Total
1	Angiosperm Anatomy	27	30	57
2	Microtechnique	9	6	15
Total		36	36	72

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Angiosperm Anatomy	Microtechnique	Total
2 marks (total 12)	9	3	Ceiling 20
5 marks (total 7)	5	2	Ceiling 30
10 marks (total 2)	2		1x10 = 10
TOTAL			60

ANGIOSPERM ANATOMY

Module – I (9 hrs)

1. Tissues - Definition, Kinds - Meristematic & Permanent. (8 hrs)

- Meristematic tissues - Classification – based on origin & position; Organization of root apex and differentiation of tissue – Histogen theory; Organization of stem apex and differentiation of tissues - Tunica & Corpus theory.
- 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. (1hr)

Module – II (6 hrs)

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

Module – III (12 hrs)

1. Normal secondary thickening in dicot stem (Vernonia). (10 hrs)

- 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. (2 hrs)

PRACTICAL (ANGIOSPERM ANATOMY)

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. A Dicot stem: Cephalandra, Centella (Primary); Vernonia (secondary).
 - b. Monocot stem: Bamboo
 - c. Dicot root: Tinospora (young –Primary; mature –Secondary)
 - d. Monocot root: Colocasia,
 - e. Anomalous secondary growth (Boerhaavia).
 - f. Dicot leaf: Ixora and Monocot leaf: grass.

References (ANGIOSPERM ANATOMY)

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

MICROTECHNIQUE

Module – I (9 hrs)

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

PRACTICAL (MICROTECHNIQUE)

1. Familiarise the structure and working of compound microscope (drawings notrequired)
2. Preparation of Safranin, FAA and Acetocarmine

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.

SEMESTER 2

BOT2C02T - ANGIOSPERM ANATOMY AND MICROTECHNIQUE

Contact Hours per Week: 4

Number of Credits: 2

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Course Outline

DISTRIBUTION OF TEACHING HOURS (18 hrs/semester = 1hr/week)

Sl. no	Subject	Theory	Practical	Total
1	Module I: Virus, Bacteria, BGA	9	5	14
2	Module II: Phycology, Mycology, Lichenology	12	13	25
3	Module III: Bryology, Pteridology, Gymnosperms	12	13	25
4	Plant Pathology	3	5	8
Total		36	36	72

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Mod 1	Mod II	Mod III	Mod IV	Total marks
2 marks (total 12)	2	4	4	2	Ceiling 20
5 marks (total 7)	2	2	2	1	Ceiling 30
10 marks (total 2)	2				1x10 = 10
Total					60

CRYPTOGAMS & GYMNOSPERMS

Module I - Virus, Bacteria, BGA (9 hrs)

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. (5 hrs)
3. Cyanobacteria: General account, structure, life - history and economic importance of Nostoc. (2 hrs)

Module II - Phycology, Mycology, Lichenology (12 hrs)

1. Phycology: General characters, classification, evolutionary trends in algae. (2 hrs)
2. Structure, reproduction, life history and economic importance of the following classes with suitable examples: (4 hrs)
 - A. Chlorophyceae (Spirogyra)

B. Phaeophyceae (*Sargassum*)

C. Rhodophyceae (*Polysiphonia*).

3. Mycology: General characters, classification (Alexopoulos, 1979) (brief mention only) and evolutionary trends, economic importance in fungi. (2 hrs)

4. Important features of the following divisions (brief account only) (1 hr)

A. Mastigomycotina

B. Zygomycotina

C. Ascomycotina

D. Basidiomycotina.

5. Structure and life history of Puccinia (developmental details not required) (2 hrs)

6. Lichenology: General account and economic importance of Lichens with special reference to Usnea. (1hr)

Module III - Bryology, Pteridology, Gymnosperms (12 hrs)

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

2. Pteridology: General account, morphology and life history of Selaginella (4 hrs)

3. Gymnosperms: General account, morphology and life history of Cycas (4 hrs)

PRACTICAL (CRYPTOGAMS & GYMNOSPERMS)

1. Make suitable micro preparations of vegetative and reproductive structures of Sargassum, Puccinia, Riccia, Selaginella and Cycas

2. Identify and draw labeled diagrams of all the types mentioned in the syllabus

References (CRYPTOGAMS & GYMNOSPERMS)

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. Mamatha Rao, (2009) – Microbes and Non-flowering plants. Impact and applications. Ane Books, New Delhi.

6. Sanders, W.B. (2001) Lichen interface between mycology and plant morphology. Bioscience, 51: 1025-1035.

7. B.R. Vasishta. Introduction to Fungi.

8. P.C. Vasishta Introduction to Bryophytes.

9. B.P. Pandey Introduction to Pteridophytes

10. Chamberlain C.J., (1935) Gymnosperms – Structure and Evolution, Chicago University Press.

11. Sreevastava H.N. (1980) A Text Book of Gymnosperms. S. Chand and Co. Ltd., New Delhi.
12. Vasishta P.C. (1980) Gymnosperms. S. Chand and Co., Ltd., New Delhi.

PLANT PATHOLOGY

Module I (3 hrs)

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.

PRACTICAL (PLANT PATHOLOGY)

- 1) Identify the diseases (mentioned in the theory syllabus) on the basis of symptoms and causal organisms. (Drawings can be replaced by photos pasted in the record).

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.

SEMESTER 3

BOT3C03T - MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND HORTICULTURE

Contact Hours per Week: 5

Number of Credits: 2

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Course Outline

DISTRIBUTION OF TEACHING HOURS (18 hrs/semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Morphology	8	4	12
2	Systematic Botany	28	20	48
3	Economic Botany	4	4	8
4	Plant Breeding	7	4	11
5	Horticulture	7	4	11
Total		54	36	90

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Morphol.	Syst. Bot.	Econ. Bot.	Pl. Br.	Horti.	Total
2 marks (total 12)	2	4	2	2	2	Ceiling 20
5 marks (total 7)	1	3	1	1	1	Ceiling 30
10 marks (total 2)	2					1x10 = 10
TOTAL						60

MORPHOLOGY

Module - I

1. Leaf – Structure, simple, compound, venation and phyllotaxy. (2 hrs)
2. Inflorescence - racemose, cymose, special, types with examples (3 hrs)
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. (3 hrs)

PRACTICAL (MORPHOLOGY)

1. Identify the types of inflorescence mentioned in the syllabus. All the types mentioned must be represented in the photo album. (All drawings in record are replaced by photo album submission).

Reference (MORPHOLOGY)

1. Sporne, K.R. (1974) Morphology of Angiosperms. Hutchinson.

SYSTEMATIC BOTANY

Module I

1. Introduction, scope and importance (1 hrs)
2. Herbarium techniques: collection, drying, poisoning, mounting & labeling. Significance of herbaria and botanical gardens; important herbaria and botanical gardens in India. (3 hrs)
3. Nomenclature - Binomial system of nomenclature, basic rules of nomenclature (validity, effectivity and priority), ICN for algae, fungi and plants. (4 hrs)
4. Systems of classification - Artificial, Natural of Phylogenetic (Brief account only). Bentham & Hooker's system of classification in detail.(4 hrs)
5. Modern trends in taxonomy - Chemotaxonomy, Numerical taxonomy and Cytotaxonomy (brief account only) (4 hrs)
6. Study the following families: Malvaceae, Fabaceae (with sub-families) Rubiaceae, Apocynaceae, Euphorbiaceae and Poaceae. (12 hrs)

PRACTICAL (SYSTEMATIC BOTANY)

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 of two plants belong to each family and record the same.
3. Familiarization of herbarium techniques (Demonstration only).
4. Mounting of a properly dried and pressed specimen of any wild plant from any one of the families mentioned in the syllabus, with proper herbarium label (to be submitted in the record book).
5. Students shall submit original images of plants, at least one from each family mentioned in the syllabus duly certified by HOD, at time of examination. Web sourced and outsourced images should not be used. The images of plants should be properly identified and they should carry details like systematic position,

GPS location, date, name and register no. of the student etc. Habitat, Habit, Inflorescence and single flower should be represented. The images can be submitted along with the photo album containing images of inflorescence mentioned under morphology. Individuality should be strictly maintained while preparing the photo album.

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, Cambridge University Press, London.
4. Gurucharan Singh, (2001) Plant Systematics. Theory and practice. Oxford & IBH Publications New Delhi.
5. Gurucharan Singh, (2019) Plant Systematics - An Integrated Approach, 4th edition. CRC Press. Florida.
6. Sharma O.P. (1990) Plant Taxonomy – Tata McGraw Hills. Publishing company Ltd.
7. Subramanyam N.S. (1999) Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
8. Pandey & Misra. (2008) Taxonomy of Angiosperms. Ane books Pvt Ltd.

ECONOMIC BOTANY

Module I (4 hrs)

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 longa.

PRACTICAL (ECONOMIC BOTANY)

1. Identify at sight the economically important plant produces and products mentioned in module III, and learn the binomial and family of the source plants, morphology of the useful parts and uses. (Drawing not required)

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

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

polyploidy breeding and f) breeding for disease resistance. (6hrs)

PRACTICAL (PLANT BREEDING)

1. Demonstration of hybridization techniques.

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, Publishers. Oxford & IBH

HORTICULTURE

1. Horticulture- introduction: definition, branches, significance (1 hr)
2. Methods of plant propagation (6 hrs)
 1. Seed propagation
 2. Vegetative propagation
 3. Cutting – stem, root, leaf
 4. Layering –air layering
 5. Grafting: Approach grafting, Tongue grafting
 6. Budding: Patch and T-budding

PRACTICAL (HORTICULTURE)

- 1) Demonstration of layering, grafting and budding

REFERENCES (HORTICULTURE)

1. K. Manibhushan Rao. (2005). Text book of Horticulture, Macmillan India Ltd.
2. N. Kumar. (1996) Introduction to Horticulture – First Edition, Rajalakshmi Publication,

SEMESTER 4

BOT4C04T - PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

Contact Hours per Week: 5

Number of Credits: 2

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Course Outline

DISTRIBUTION OF TEACHING HOURS (18 hrs/semester = 1hr/week)

Sl no	Subject	Theory	Practical	Total
1	Plant physiology	36	18	54
2	Ecology	9	9	18
3	Genetics	9	9	18
Total		54	36	90

QUESTION PAPER PATTERN & SUBJECT WISE DISTRIBUTION OF MARKS

Type of questions	Plant physiol.	Ecology	Genetics	Total
2 marks (total 12)	8	2	2	Ceiling 20
5 marks (total 7)	4	1	2	Ceiling 30
10 marks (total 2)	2			1x10 = 10
TOTAL				60

PLANT PHYSIOLOGY

Module I (16 hrs)

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.
6. Mineral nutrition- General account on Micro and macro nutrients. Methods of studying plant nutrition- solution culture-The essential elements - criteria of essentiality. function and deficiency symptoms of the following mineral nutrients: N, P, K, Mg, Fe, Zn, Mn

Module II (10 hrs)

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, C₄ cycle, photorespiration (a brief account only). Factors affecting photosynthesis.

Module III (10 hrs)

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

PRACTICAL (PLANT PHYSIOLOGY)

Learn the principle and working of the following apparatus/experiments

1. Thistle funnel osmoscope
2. Ganong's potometer
3. Ganong's light-screen
4. Absorbo transpirometer .
5. Kuhne's fermentation vessel
6. Mohl's half-leaf experiment
7. Experiment to show evolution of O₂ during photosynthesis

References (PLANT PHYSIOLOGY)

1. William G. Hopkins (1999). Introduction to Plant Physiology, 2nd edition, John Wiley & 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 (1983) 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

Module I (9 hrs)

1. Ecology-Definition, Ecosystem: ecological factors –biotic and abiotic.
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).
3. Ecological succession –Process of succession, types of succession, Hydrosere.

PRACTICAL (PLANT ECOLOGY)

Study the morphological and anatomical adaptations of the hydrophytes, xerophytes, halophytes, epiphytes and parasites mentioned in the syllabus (drawing not required)

REFERENCES (PLANT ECOLOGY)

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 (9 hrs)

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

PRACTICAL (GENETICS)

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

References (GENETICS)

1. Sinnot, W.L.C. Dunn & J. Dobzhansky (1996) Principles of Genetics. Tata McGraw 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 PAPERS: (THEORY)
FIRST SEMESTER B.Sc. DEGREE PROGRAMME
BOTANY COMPLEMENTARY COURSE: I
BOT1C01T
ANGIOSPERM ANATOMY AND MICROTECHNIQUE

TIME: 2 Hrs

Max. Marks 60

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between lateral meristem and intercalary meristem.
2. What is FAA? How is it prepared?
3. Explain Tunica Corpus theory.
4. What is quiescent centre?
5. How do tracheids differ from vessels?
6. What are hydathodes?
7. Explain the structure and function of bulliform cells.
8. What are annual rings? What is its relevance?
9. What are tyloses?
10. Write short note on rotary microtome.
11. Different between protoxylem and metaxylem.
12. What is acetocarmine? What is its use?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Write short note on simple tissues.
14. What are the different types of vascular bundles?
15. Explain the principle and types of electron microscopes.
16. Describe the laticiferous tissues in plants.
17. Explain the structure of a dicot leaf.
18. With a neat labeled diagram, explain the primary structure of monocot root.
19. Explain killing and fixing. Add a note on various agents used for it.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. What are permanent tissues? Explain the major classes with their functions.
21. Explain the secondary growth in dicot stem with the help of a diagram.

SECOND SEMESTER B.Sc. DEGREE PROGRAMME

BOTANY COMPLEMENTARY COURSE: 2

BOT2C02T

CRYPTOGAMS, GYMNOSPERMS & PLANT PATHOLOGY

TIME: 2 Hrs

Max. Marks 60

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between fimbriae and pili.
2. What are plasmids? Mention the different types.
3. Explain the structure of cell wall of bacteria.
4. Give an account of morphology of Sargassum thallus.
5. What are heterocysts? Give its function.
6. Briefly explain scalariform conjugation in Spirogyra.
7. Comment on the structure and function of ligule in Selaginella.
8. Write a short note about the sporogonium of Riccia.
9. What are coralloid roots? What is its function?
10. List out the important symptoms of Leaf mosaic disease of Tapioca.
11. Describe vegetative reproduction in bryophytes.
12. Enumerate the important control measures of citrus canker.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account of the multiplication of bacteriophages.
14. Name the pathogen, symptoms and control measures of Blast of paddy.
15. With the help of a labelled diagram explain the anatomy of Riccia thallus.
16. What is the ecological and economic importance of lichens?
17. How are bacteria classified based on flagella? Add a note on bacterial growth.
18. Briefly explain the post fertilization changes in Polysiphonia.
19. Write about the sexual reproduction in Cycas.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Write an essay on the vegetative, asexual and sexual reproduction of bacteria.
21. With the help of suitable diagrams describe the stages of life cycle of Puccinia.

THIRD SEMESTER B.Sc. DEGREE PROGRAMME

BOTANY COMPLEMENTARY COURSE: 3

BOT3C03T

**MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY, PLANT BREEDING AND
HORTICULTURE**

TIME: 2 Hrs

Max. Marks 60

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. Differentiate between stock and scion.
2. Write a short note on the inflorescence of Poaceae.
3. Explain the significance of quarantine.
4. What are the advantages of seed propagation?
5. What is aestivation? What are the different types?
6. Name any two chemicals used for the poisoning of specimens.
7. Differentiate between synandrous stamens and syngeneceous anthers.
8. Name any two major herbaria in India.
9. Differentiate between numerical taxonomy and chemotaxonomy?
10. Write the binomial and family of clove and turmeric.
11. What are beverages?
12. Describe emasculation. What are the different types of emasculation?

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Expand ICN? What are the major rules of ICN?
14. What are the different types of inflorescences?
15. Write short note on cereals and pulses.
16. Enumerate the characteristic features of family Fabaceae.
17. Describe polyploidy breeding. What are their applications in crop improvement?
18. What are the important vegetative propagation methods in plants?
19. Comment on the phylogenetic system of classification

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. What is a natural system of classification? Explain with an example. Write down the major merits and demerits.
21. Describe the different selection processes in plant breeding? Explain.

FOURTH SEMESTER B.Sc. DEGREE PROGRAMME
BOTANY COMPLEMENTARY COURSE: 4
BOT4C04T
PLANT PHYSIOLOGY, ECOLOGY AND GENETICS

TIME: 2 Hrs

Max. Marks 60

SECTION A

(Answer all questions, each question carries 2 marks. Ceiling: 20 Marks)

1. What are antitranspirants? Give examples.
2. Define water potential? Write about its components.
3. Explain vernalization in brief.
4. Give an account of ATPase.
5. What is transpiration pull? Explain its role in plants.
6. Write about senescence and abscission. Add a note their significance.
7. Describe two important adaptations seen in halophytes.
8. What are haustoria? Mention its physiological importance.
9. Differentiate test cross and back cross.
10. What are complementary genes? Give example.
11. Write about Krantz anatomy.
12. Give an account of Hydroponics.

SECTION B

(Answer all questions, each question carries 5 marks. Ceiling: 30 Marks)

13. Give an account of non-cyclic photophosphorylation.
14. Describe the K⁺ ion theory of stomatal movements.
15. Write in detail about the adaptations of xerophytes.
16. List out the roles played by gibberellins in plant development.
17. Give an account of the epistatic interaction found in plants with an example.
18. Briefly explain the dihybrid cross conducted by Mendel and a note on the discovery of law of independent assortment.
19. Give an account of the causes and methods to overcome seed dormancy.

SECTION C

(Answer any one question, each question carries 10 marks. 1x10 = 10 Marks)

20. Define plant succession. Describe the stages of hydrosere in detail with suitable plant examples
21. With the help of schematic diagram describe the path of carbon in Photosynthesis.

MODEL QUESTION PAPER: (PRACTICAL)

**FOURTH SEMESTER B.Sc. DEGREE PROGRAMME COMPLEMENTARY BOTANY
PRACTICAL EXAMINATION**

BOT4C05P

**(Angiosperm Anatomy, Micro technique, Cryptogams, Gymnosperms, Plant Pathology,
Morphology, Systematic Botany, Plant Physiology, Ecology, Genetics, Economic Botany, Plant
Breeding & Horticulture)**

TIME: 3 Hrs

Max. Marks 60

1. Prepare a T.S. of specimen A. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation. (Preparation-2; Diagram-2; Reasons-2; Identification-1) 7 x1=7 Marks
2. Refer specimen B to its family, giving diagnostic characters (Identification-1; Reasons-2) 3x1=3 Marks
3. Take a V.S. of flower C. Draw a labeled diagram 2x1=2 Marks
4. Make suitable micro-preparations of D. Draw labeled diagram. Identify giving reasons. Leave the preparation for valuation. (Preparation-2; Diagram-2; Identification-1; Reasons-1) 6x1=6 Marks
5. Determine the ecological group of specimen E, with important adaptations. (Identification-1; Adaptations-2) 3 x1=3 Marks
6. Identify the experiment F and G. Explain the aim and working (Identification-1; Aim-1; Working - 1) 3 x 2= 6 Marks
7. Give the binomial, family and morphology of useful parts in H and I (Binomial-1; Family- ½ ; Morphology of useful part- ½) 2×2=4 Marks
8. Name the disease, pathogen and important symptoms in J (Name- 1; Pathogen- 1 ; Symptoms-1) 3x1=3 Marks
9. Give the binomial and family of K and L (Binomial-1; Family ½) 2×1 ½ = 3 Marks
10. Work out the problem M 5x1=5 Marks
11. Spot at sight N to V 9 X 2= 18 marks

**Practical : 60 Marks
Record : 15 Marks
Submission : 10 Marks
Total: 85 Marks**