

COMPLEMENTARY COURSE- BOTANY

COURSE STRUCTURE, WORK LOAD AND CREDIT DISTRIBUTION

Semester	Paper Code	Title of Paper	Hours/ Semester	Hours allotted / Week	Credit
S I	BOT1C01 T	COMPLEMENTARY COURSE 1. Angiosperm Anatomy & Micro technique	36 hrs	2	2
	-	Complementary Course -1 Practical	36 hrs	2	*
S II	BOT2C02 T	COMPLEMENTARY COURSE 2. Cryptogams, Gymnosperms & Plant Pathology	36 hrs	2	2
	-	Complementary Course -2 Practical	36 hrs	2	*
S III	BOT3C03 T	COMPLEMENTARY COURSE - 3 Morphology, Systematic Botany, Eco. Botany, Plant Breeding & Horticulture	54 hrs	3	2
	-	Complementary Course-3 Practical	36 hrs	2	*
S IV	BOT4C04 T	COMPLEMENTARY COURSE - 4 Plant Physiology, Ecology & Genetics	54 hrs	3	2
	-	Complementary Course -4 Practical	36 hrs	2	*
	BOT4C05 P	COMPLEMENTARY COURSE- 5 Practical Paper 1 Angiosperm Anatomy, Microtechnique, Cryptogams, Gymnosperms, Plant Pathology, Morphology, Systematic Botany, Plant Physiology, Ecology, Genetics, Eco. Botany, Plant Breeding & Horticulture			4
TOTAL					12
· Credits of practical paper (total given against Practical paper BOT4C05 P)					

COURSE STRUCTURE, MARK DISTRIBUTION, SCHEME OF EXAMINATION

Course code & Title of course	Total Hours		Duration of Exams	Marks				Total Marks
	Theory	Practical		Theory		Practical		
				External	Internal	External	Internal	
Semester -1 : BOT1C01 T Anatomy & Microtechnique	36	36	2 hrs	60	15	--	--	75
Semester-2 :BOT2C02 T Cryptogams, Gymnosperms & Plant Pathology	36	36	2 hrs	60	15	--	--	75
Semester-3: BOT3C03 T Morphology, Syst. Botany, Economic Botany, Plant Breeding & Horticulture	54	36	2 hrs	60	15	--	--	75
Semester- 4: BOT4C04 T Plant Physiology, Ecology & Genetics	54	36	2 hrs	60	15	--	--	75
Semester- 4: BOT4C05 P Comple. Course Practical External Practical Exam Record Submission	--	--	3 hrs	--	--	60 15 10	15	100
Total	180	144		240	60	85	15	400

Table 14. 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%.		

COMPLEMENTARY COURSE: 1
ANGIOSPERM ANATOMY AND MICROTECHNIQUE

Semester	Course code	Credits	Hrs/wk	Marks (Ext.+Int.)	Duration of exam
1	BOT1C01	2	4	60 + 15	2 hrs

COURSE OUTCOMES (COs)

By the end of the course, students are expected to:

1. Explain the types, structure and functions of plant tissues
2. Explain primary and secondary (normal and anomalous) structures of plant organs.
3. Identify plant organs by observing anatomical features.
4. Illustrate primary and secondary (normal and anomalous) structures of plant organs.
5. Apply the histochemical techniques in laboratory works

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)
 1. 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.
 2. Permanent tissues - Definition - classification; Simple tissues (Parenchyma, Collenchyma and Sclerenchyma), Complex tissues (Xylem & Pholem) Secretory tissues - Glandular tissues (Nectaries in *Euphorbia pulcherrima*, Stinging hairs in *Tragia*) Oil glands in *Citrus*, *Eucalyptus*; Digestive glands in *Nepenthes*; Laticiferous tissues (Non-articulate latex ducts in *Euphorbia* and articulate latex duct - latex vessels in *Hevea*). Hydathodes
- 2 Vascular bundles - types: conjoint - collateral, bicollateral, concentric and radial. (1 hr)
3. Non-living cell inclusions – Raphids, cystoliths, prismatic crystals

Module - II (6 hrs)

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

Module - III (12 hrs)

1. Normal secondary thickening in dicot stem (*Vernonia*) (10 hrs)
 - 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/ Ficus*)
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. Dicot stem: *Cephalandra, Centella* (Primary structure); *Vernonia* (secondary structure).
 - b. Monocot stem: Bamboo/ grass
 - c. Dicot root: *Tinospora/ Ficus* (young -Primary; mature -Secondary)
 - d. Monocot root: *Colocasia/ Musa*
 - e. Anomalous secondary growth (*Boerhaavia*).
 - f. Dicot leaf: *Hibiscus* and Monocot leaf: paddy/ grass

REFERENCES: (ANGIOSPERM ANATOMY)

1. Cuttler, E.G. 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.)

3. Dehydration and clearing - reagents (mention only)
4. Stains - Saffranin and acetocarmine, preparation and use.

PRACTICAL (MICROTECHNIQUE)

- 1 Familiarise the structure and working of compound microscope (drawings not required)
- 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.

COMPLEMENTARY COURSE: 2
CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY

Semester	Course code	Credits	Hrs/wk	Marks (Ext.+Int.)	Duration of exam
2	BOT2C02	2	4	60 + 15	2 hrs

COURSE OUTCOMES (COs)

By the end of the course, students are expected to:

1. Analyze the role of the lower plants in the process of evolution.
2. Explain the ecological significance of lower plants
3. Identify plant diseases and take remedial measures to control them.

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 I	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: (a) General account and economic importance of Lichens with special reference to *Usnea*. (b) Briefly explain the morphology and life-history of *Usnea*. (3 hrs)

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

- 1. Bryology: General account, morphology, anatomy of thallus and life - history of *Riccia* (4 hrs)
- 2. Pteridology: General account, morphology, anatomy of the stem 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 structures of *Sargassum (stipe)*, *Puccinia*, *Riccia thallus*, *Selaginella stem*
- 2. Make the micropreparation of *Puccinia teleutosori*
- 3. 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.

**COMPLEMENTARY COURSE 3:
MORPHOLOGY, SYSTEMATIC BOTANY, ECONOMIC BOTANY,
PLANT BREEDING AND HORTICULTURE**

Semester	Course code	Credits	Hrs/wk	Marks (Ext.+Int.)	Duration of exam
3	BOT3C03	2	5	60 + 15	2 hrs

COURSE OUTCOMES (COs)

By the end of the course, students are expected to:

1. Appreciate the diverse morphology of angiosperms.
2. Identify and classify plants based on taxonomic principles
3. Make scientific illustrations of vegetative and reproductive structures of plants
4. Identify the economically important plants
5. Understand the basic principles of plant breeding
6. Apply various horticultural practices in the field.

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 records 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, Phylogenetic, APS
Bentham & Hooker's system of classification (Brief account only). (4 hrs)
5. Modern trends in taxonomy - Chemotaxonomy, Numerical taxonomy, Cytotaxonomy and molecular taxonomy (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.

6. Demonstration of simple DNA extraction method

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. (1999) Modern Plant Taxonomy. Vikas Publishing House Pvt Ltd.
- 7 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. Millets: Ragi
 3. Pulses: Black gram, Green gram
 4. Oil: Coconut, Gingelly
 5. Fibre: Cotton
 6. Latex: Rubber
 7. Beverages : Tea, Coffee
 8. Spices: Pepper, Cardamom, Clove
 9. Medicinal plants: *Rauvolfia serpentina*, *Justicia adhatoda*, *Ocimum sanctum* and *Curcuma longa*.

PRACTICAL (ECONOMIC BOTANY)

- 1 Identify at sight the economically important plants 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 hrs)
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 (5 hrs)
3. Application of Biotechnology in plant breeding-GM Crops, Bt cotton, Golden rice, Flavr-Savr, Edible vaccine (1hr)

PRACTICAL (PLANT BREEDING)

- 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, Publishers. Oxford & IBH

HORTICULTURE

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

PRACTICAL (HORTICULTURE)

- 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)

**COMPLEMENTARY COURSE 4:
PLANT PHYSIOLOGY, ECOLOGY AND GENETICS**

Semester	Course code	Credits	Hrs/wk	Marks (Ext.+Int.)	Duration of exam
3	BOT4C04	2	5	60 + 15	2 hrs

COURSE OUTCOMES (COs)

By the end of the course, students are expected to:

1. Explain the physiological processes in plants.
2. Understand the basic principles of heredity and variation.
3. Realize the importance of ecology.
4. Spread awareness of the necessity of conservation of biodiversity and natural resources
5. Solve problems related to classical genetics

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			1x 10 = 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) (18 hrs)

Learn the principle and working of the following apparatus/experiments

1. Thistle funnel osmoscope

2. Ganong's potometer

3. Ganong's light-screen

4. Ganong's respirometer

5. Absorbo transpirometer

6. Kuhne's fermentation vessel

7. Mohl's half-leaf experiment

8. Experiment to demonstrate suction due to transpiration

9. Experiment to show evolution of O₂ during photosynthesis

REFERENCES (PLANT PHYSIOLOGY)

1. William G. Hopkins (1999). Introduction to Plant Physiology, 2nd edition, John Wiley A Sons, Inc.

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

Module – I (9hrs)

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

4. Ecological interactions of Plants with insects (Brief account only)

PRACTICAL (ECOLOGY)

(9 hrs.)

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

REFERENCES (ECOLOGY)

1. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co. Varanasi.
2. Ananthakrishnan T. N. 1992. Dimensions of Insect-Plant Interactions. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
4. Michael S. 1996. Ecology. Oxford University Press, London.
5. Sharma, P.D. 2008-2009. Ecology and Environment. Rastogi Publication.
6. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.
7. Rosenthal GA, Berenbaum MR. 1992. Herbivores, their interactions with secondary plant metabolites, second edition, Vol. II: Ecological and Evolutionary Processes, Academic Press Inc. Harcourt Brace Jovanovich Publishers, USA.

GENETICS (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),
- 6 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

COMPLEMENTARY COURSE I

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 COMPLEMENTARY BOTANY

COMPLEMENTARY COURSE: 2

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 COMPLEMENTARY COURSE 3 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 syngeneceious 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 COMPLEMENTARY BOTANY COMPLEMENTARY COURSE 4: 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 Kranz 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)

B.Sc. COMPLEMENTARY BOTANY PRACTICAL EXAMINATION

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

Time: 3 hrs

Max: 60 marks

1. Prepare a T.S. of specimen **A**. Stain and mount in glycerine. Draw cellular diagram and label the parts. Identify giving reasons. Leave the preparation for valuation.
(Preparation-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