

YOGI VEMANA UNIVERSITY: KADAPA
Course Structure of B.Sc Botany under CBCS

Year	Semester	Paper	Title	Hours	Credits	IA	ES	TOTAL		
I	I	I	Microbial Diversity , Algae and Fungi	4	03	25	75	100		
			Practical –I	2	02	50	0	50		
	II	II	Diversity Of Archaeogoniates & Anatomy	4	03	25	75	100		
			Practical –II	2	02	0	50	50		
II	III	III	Plant taxonomy & Embryology	4	03	25	75	100		
			Practical –III	2	02	50	0	50		
	IV	IV	Plant physiology & Metabolism	4	03	25	75	100		
			Practical –IV	2	02	0	50	50		
III	V	V	Cell Biology, Genetics & Plant breeding	3	03	25	75	100		
			Practical –V	2	02	50	0	50		
		VI	VI	Plant Ecology & Phytogeography	3	03	25	75	100	
				Practical –VI	2	02	50	0	50	
	VI	VII	VII	Plant Tissue Culture and its Biotechnological Applications	3	03	25	75	100	
				Lab	2	02	0	50	50	
		VIII-A	VIII-A	VIII-A	Cluster Elective-	3	03	25	75	100
					A VIII-A-1:	3	03	25	75	50
					Biological instrumentation and Methodology	3	03	25	75	100
					VIII-A-2	2	02	0	50	50
					:Mushroom Culture and Technology	2	02	0	50	100
VIII-A-3: Internship/ Project Work	2	02	0	50	50					

I B.Sc - SEMESTER- I: BOTANY SYLLABUS

Paper- I : Microbial Diversity, Algae and Fungi

Total hours of teaching 60hrs @ 4 hrs per week

UNIT- I: MICROBIAL WORLD (Origin and Evolution of Life, Microbial diversity (12hrs)

1. Discovery of microorganisms, origin of life, spontaneous, biogenesis, Pasteur experiments, germ theory of disease.
2. Classification of microorganisms – R.H. Whittaker's five kingdom concept, Carl Woese's- Domain system.
3. Brief account of special groups of bacteria- Archaeobacteria, Mycoplasma, Actinomycetes and Cyanobacteria.

UNIT- II: VIRUSES (12hrs)

1. Viruses- Discovery, general account, structure&replication of –T4 Phage (Lytic, Lysogenic) and TMV, Viroids, Prions.
2. Plant diseasescaused by viruses– Symptoms, transmission and control measures (Brief account only).
3. Study of Tobacco Mosaic, Bendi Vein clearing and Papaya leaf curl diseases.

UNIT III: BACTERIA (12hrs)

1. Bacteria: Discovery, General characteristics, cell structure and nutrition.
2. Reproduction- Asexual and bacterial recombination (Conjugation, Transformation, Transduction).
3. Economic importance of Bacteria.

UNIT –IV Algae (12hrs)

1. General account - thallus organization and reproduction in Algae.
2. Fritsch classification of Algae (up to classes only) and economic importance.
3. Structure, reproduction and life history of *Oedogonium*, *Ectocarpus* and *Polysiphonia*.

UNIT V: FUNGI (12hrs)

1. General characteristics and outline classification (Ainsworth).
2. Structure, reproduction and life history of *Rhizopus* (Zygomycota), *Penicillium* (Ascomycota), and *Puccinia* (Basidiomycota).
3. Lichens-Structure and reproduction; ecological and economic importance.

Suggested activity: Seminar, Quiz, debate, collection of diseased plant parts – studying symptoms and identification of pathogen, collection and study of fresh and marine Algae available in local area.

Books for Reference:

1. Oladele Ogunseitan (2008) Microbial Diversity: Form and Function in Prokaryotes Wiley- Blackwell.
2. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata Mc Graw-Hill Co, New Delhi.
3. Prescott, L. Harley, J. and Klein, D. (2005) Microbiology, 6th edition, Tata Mc Graw- Hill Co. New Delhi.
4. Fritsch F.E. (1935 The Structure & Reproduction of Algae 1945): Cambridge University Press Cambridge, U.K. Vol. I, Vol. II.
5. Smith, G.M (1955) :Cryptogamic Botany(Vol. I Algae, Fungi, & Lichens) McGraw-Hill Book Co., New York .
6. Ian Morris (1967): An Introduction to the Algae, Hutchinson, London.
7. Alexopoulos,C.J., Mims, C.W. & Blackwell, M. (1996): Introductory Mycology John Wiley& Sons., Inc., N.Y., Chicester, Berisbane, Toronto, Singapore.
8. Webster, J (1999) : Introduction to Fungi(2nd edition) Cambridge University Press.

****Student Activities like Seminars, Assignments, Fieldwork, Study Projects, Models etc. are Part of Curriculum for all units in all papers.**

I B.Sc – SEMESTER –I: BOTANY PRACTICAL SYLLABUS**Paper-I: Microbial Diversity, Algae and Fungi**

Total hours of laboratory Exercises 30 hrs @ 2 per week

1. Knowledge of Equipment used in Microbiology: Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, laminar air flow chamber and Incubator.
 2. Preparation of liquid and solid media for culturing of microbes (Demonstration).
 3. Study of viruses and bacteria using electron photo micrographs (TMV, Bacteriophage, HIV, Cocci, Bacillus, Spirillum bacteria).
 4. Gram staining technique.
 5. Study of Plant disease symptoms caused by Bacteria (Citrus canker, leaf blight of rice, Angular leaf spot of Cotton) and viruses (TMV, Bhendi vein clearing and Leaf curl of Papaya),Fungi (Late blight of potato, Red rot of Sugarcane and Paddy blast).
 6. Study of vegetative and reproductive structures of the following :
 - a) **Cyanobacteria:** *Nostoc and Scytonema*.
 - b) **Algae:** *Oedogonium, Ectocarpus, Polysiphonia*,
 - c) **Fungi:** *Rhizopus, Penicillium and Puccinia* .
 7. Study of plant materialinfected by Fungi (Rot of tomatoes,blue and greenmoulds of Ciitrus fruits and wheat rust(Section cutting of diseased parts of Wheat and Barberry -identification of different spores).
 8. Lichens: Morphology and of anatomy of different thalli.
 9. Field Visit.
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B.Sc - SEMESTER –I BOTANY PRACTICAL PAPER –I
Paper-1 P: Microbial Diversity, Algae and Fungi

Time: 3hrs.

Max. Marks: 50

1. Identify giving reasons two of the given **Algal mixture” A"**. Leave your preparation for evaluation. Draw labeled diagrams. (Slide--1mark, Diagrams--1mark, Identification--1mark)
 3x 2 = 6 Marks

2. Make suitable stained preparation of the **material "B"** to bring out the details of internal structure--identify giving reasons. Draw labeled diagrams and leave your preparations for evaluation.

(Slide-4 marks, diagrams-3 marks, Identification-3marks)

10 Marks

3. Perform Gram staining of the given Bacterial culture

9 Marks

4. Write critical notes and Identify D, E, F, G and H

(5X3)= 15 Marks

5. Record(submission is compulsory)

10 Marks

Total: -----
 50 Marks

Key:

A. Algal material

B. Fungi material

C. Bacterial culture

D. One of the instruments of Micro biology laboratory.

E. Whole specimen or a permanent slide of Algae.

F. Whole specimen or a permanent slide of Fungi.

G. Whole specimen or a permanent slide of Plant disease studied.

H. Whole specimen or a permanent slide of Lichens.

I B. Sc - SEMESTER- II: BOTANY THEORY SYLLABUS

Paper –II : Diversity of Archaeoniatates & Plant Anatomy

Total hours of teaching 60hrs @ 4 hrs per week

UNIT – I: BRYOPHYTES

(12hrs)

1. Bryophytes: General characters, Classification (up to classes)
2. Structure, reproduction and Life history of *Marchantia*, and *Funaria*.
3. Evolution of Sporophyte in Bryophytes.

UNIT - II: PTERIDOPHYTES

(12hrs)

1. Pteridophytes: General characters, classification (up to Classes)
2. Structure, reproduction and life history of *Lycopodium*, and *Marsilea*.
3. Heterospory and seed habit.
4. Evolution of stele in Pteridophytes.

UNIT – III: GYMNOSPERMS

(12hrs)

1. Gymnosperms: General characters, classification (up to classes)
2. Morphology, anatomy, reproduction and life history of *Pinus* and *Gnetum*
3. Economic importance with reference to wood, essential oils and drugs

UNIT –I V: Tissues and Tissue systems

(12hrs)

1. Meristems - Root and Shoot apical meristems and their histological organization.
2. Tissues – Meristematic and permanent tissues (simple, complex, secretory)
3. Tissue systems–Epidermal, ground and vascular.

UNIT – V. Secondary growth

(12hrs)

1. Anomalous secondary growth in *Achyranthes*, *Boerhaavia* and *Dracaena*
2. Study of local timbers of economic importance-Teak, Rosewood, Red sanders and Arjun (Tella maddi).

Suggested activity: Collection of *Marsilea* sporocarp, *Pinus* needles, male and female cones, study of *Pinus* pollen grains, collection of locally available economically useful timbers.

Books for Reference:

1. Cavers, Frank (): The inter-relationships of the Bryophytes New Phytologist, Indian Reprint.
2. Smith, G.M. (1955): Cryptogamic Botany Vol. II. (2nd Edition) (Bryophytes & Pteridophytes) Tata McGraw Hill Publishing Co., New Delhi.
3. Parihar, N.S. (): An Introduction to embryophyta – Vol.II. Bryophyta

Central Book Depot, Allahabad.

4. Watson, E.V. (1968): British Mosses & Liverworts Cambridge University Press, U.K
5. Eames, A.J. (1936) : Morphology of Vascular Plants (Lower Groups) McGraw Hill, N.Y.
6. Parihar, N.S. (19) : An Introduction to Embryophyta Vol.II Pteridophyta

Central Book Depot., Allahabad.

7. Smith, G.M. (1955) : Cryptogamic Botany Vol.II (2nd Edn.,) (Bryophytes & Pteridophytes) Tata McGraw Hill Publishing Co., New Delhi.
8. Sporne, K.R. (1970) : The Morphology of Pteridophytes (The Structure of Ferns and Allied Plants) Hutchinson University Library, London
9. Bierhorst, D.W. (1971) : Morphology of Vascular Plants, The MacMillan Co., N.Y. & Collier- MacMillan Ltd., London.
10. Coulter, J.M.& C.J. Chamberlain (1964) : Morphology of Gymnosperms Central Book Depot, Allahabad.
11. Sporne, K.R. (1971): The Morphology of Gymnosperms (The Structure and Evolution of Primitive seed Plants) Hutchinson University Library, London.
12. Esau, K. (1965) : Vascular Differentiation in Plants. Holt, Rinehart & Winston, N.Y., Chicago, San Fransisco, Toronto, London.
13. Eames, A.J., & Mc Daniels, L.H.(1979) : An Introduction to Plant anatomy

Tata-McGraw-Hill Publishing Co., (P) Ltd. Bombay, New Delhi.

14. Esau. K.(1980) : Plant Anatomy, (2nd Edition) Wiley Eastern Ltd., New Delhi.

I B.Sc SEMESTER -II BOTANY PRACTICAL SYLLABUS
Paper-II: Diversity of Archaeogoniates & Plant Anatomy

Total hours of laboratory Exercises 30 hrs @ 2 per week

1. Morphology (vegetative and reproductive structures) , anatomy of the following:

Marchantia, Funaria, Lycopodium and *Pinus*.

2. Anatomy:

a) Demonstration of double staining technique.

b) Tissue organization in root and shoot apices using permanent slides

c) Preparation of double staining slides

d) Anomalous secondary structure of *Achyranthes, Boerhavia* and *Dracaena*.

e) Anatomical study of wood in T.S., T.L.S. and R.L.S.

3. Field visits to local timber depots.

I.Sc., SEMESTER –II: BOTANY PRACTICAL MODEL PAPER II
II P: Diversity of Archaeogoniates & plant Anatomy

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|--|---------------|
| 1. Section cutting of material -A
(Slide 3 marks, diagrams-3 marks, Identification-3 marks) | 9 Marks |
| 2. Section cutting of material -B
(Slide 3 marks, diagrams-3 marks, Identification-3 marks) | 9 Marks |
| 3. Section cutting of material-C
(Slide 4 marks, diagrams-3 marks, Identification-3 marks) | 10 Marks |
| 4. Identification of spotters - D, E, and F | 3x4 =12 marks |
| 5. Record (submission compulsory) | 10 marks |

Total : 50 Marks

Key:

- A. Bryophyta/ Pteridophyta material
 - B. Gymnosperm material.
 - C. Anatomy material.
 - D. Whole specimen or permanent slide of Bryophyta/ Pteridophytan
 - E. Whole specimen or permanent slide of Gymnosperm.
 - F. Whole specimen or permanent slide of wood.
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II B. Sc - SEMESTER –III: BOTANY THEORY PAPER –III

Paper-III : Plant Taxonomy and Embryology)

Total hours of teaching 60hrs @ 4 hrs per week

UNIT – I: INTRODUCTION TO PLANT TAXONOMY (12hrs)

1. Fundamental components of taxonomy (identification, nomenclature, classification)
2. Taxonomic resources: Herbarium- functions& important herbaria, Botanical gardens, Flora.
3. Botanical Nomenclature- Principles and rules of ICBN (ranks and names; principle of priority, binomial system; type method, author citation, valid-publication).

UNIT – II: CLASSIFICATION

(12 hrs)

1. Types of classification- Artificial, Natural and Phylogenetic.
2. Bentham & Hooker’s system of classification- merits and demerits.
3. Engler & Prantle’s system of classification- merits and demerits
4. Phylogeny – origin and evolution of Angiosperms

UNIT –III: SYSTEMATIC TAXONOMY-I

(12hrs)

1. Systematic study and economic importance of the following families:
Annonaceae, Brassicaceae, Rutaceae, Curcubitaceae, and Apiaceae.

UNIT –IV: SYSTEMATIC TAXONOMY-II

(12hrs)

1. Systematic study and economic importance of plants belonging to the following families: Asteraceae, Asclepiadaceae, Lamiaceae, Ephorbiaceae, Arecaceae, and Poaceae.

UNIT – V: EMBRYOLOGY

(12hrs)

1. Anther structure, microsporogenesis and development of male gametophyte.
2. Ovule structure and types; Megasporogenesis, development of Monosporic, Bisporic and Tetrasporic types (*Peperomia*, *Drusa*, *Adoxa*) of embryo sacs.
3. Pollination and Fertilization (out lines) Endosperm development and types.
4. Development of Dicot and Monocot embryos, Polyembryony.

Suggested activity: Collection of locally available plants of medicinal importance, observing pollen grains in honey, Aero palynology-collection of pollen from air using glycerin strips in different seasons.

Books for Reference:

1. Porter, C.L. (): Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi.
2. Lawrence, G.H.M. (1953): Taxonomy of Vascular Plants, Oxford & IBH Publishers, New Delhi, Calcutta.
3. Jefferey, C.(1968) : An Introduction to Plant Taxonomy J.A. Churchill, London.
4. Mathur, R.C.(1970) : Systematic Botany (Angiosperms) Agra Book Stores- Lucknow, Ajmer, Allahabad, Delhi.
5. Maheswari,P(1963) :Recent Advances in the Embryology of Angiosperms(Ed.,) International Society of Plant Morphologists- University of Delhi.
6. Swamy. B.G.L. & Krishnamoorthy. K.V.(1980):From flower to fruit
Tata McGraw Hill Publishing Co., Ltd., New Delhi.
7. Maheswari, P.(1985):An Introduction to the Embryology of Angiosperms
Tata McGraw Hill Publishing Co.,Ltd., New Delhi.
8. Bhojwani, S.S. & Bhatnagar, S.P. (2000) : The Embryology of Angiosperms (4th Edition) Vikas Publishing House(P)Ltd., UBS Publisher's Distributors, New Delhi.

II B.Sc BOTANY - SEMESTER-III Paper-III: PRACTICAL**Plant Taxonomy and Embryology**

Total hours of laboratory Exercises 30hrs @ 2 per week

Suggested Laboratory Exercises:

1. Systematic study of locally available plants belonging to the families prescribed in theory syllabus.
 2. Demonstration of herbarium techniques.
 3. Structure of pollen grains using whole mounts (*Catharanthus, Hibiscus, Acacia, Grass*).
 4. Demonstration of Pollen viability test using *in-vitro* germination (*Catharanthus*).
 5. Study of ovule types and developmental stages of embryo sac using permanent slides/Photographs.
 6. Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot Embryos using permanent slides / Photographs
 7. Isolation and mounting of embryo (using *Symopsis / Senna / Crotalaria*)
 8. Field visits .
 9. Study of local flora and submission of Field Note Book.
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II B.Sc., BOTANY- SEMESTER -III PRACTICAL MODEL PAPER III**Plant Taxonomy and Embryology**

1. Describe the given Plant specimens (A & B) in technical terms. Draw neat labeled diagrams of twig with inflorescence, L.S. of Flower, T.s. of Ovary and floral Diagram. Give floral formula. Identify the family.

2x 10 = 20 Marks

(Description- vegetative - 2 marks, floral – 4 marks; diagrams-3 marks, Identification-1 marks)

2. Derive the plant specimens C & D to their respective families-

2x4 = 08 marks

3. Identification of spotters - D, E, and F (Embryology)

3x4 =12 marks

4. Record & Herbarium (submission compulsory)

10 marks

Total : 50 Marks

I B.Sc. BOTANY, SEMESTER- IV, Paper-IV: THEORY SYLLABUS**PAPER –IV: Plant Physiology and Metabolism**Total hours of teaching 60hrs @ 4 hrs per week

UNIT – I: Plant – Water relations (12 hrs)

1. Physical properties of water, Importance of water to plant life.
2. Diffusion, imbibition and osmosis; concept & components of Water potential.
3. Absorption and transport of water and ascent of sap.
4. Transpiration –Definition, types of transpiration, structure and opening and closing mechanism of stomata.

UNIT –II: Mineral nutrition & Enzymes (12hrs)

1. Mineral Nutrition: Essential elements (macro and micronutrients) and their role in plant metabolism, deficiency symptoms.
2. Mineral ion uptake (active and passive transport).
3. Nitrogen metabolism- biological nitrogen fixation in *Rhizobium*, outlines of protein synthesis (transcription and translation).
4. Enzymes: General characteristics, mechanism of enzyme action and factors regulating enzyme action.

UNIT –III: PHOTOSYNTHESIS (12 hrs)

1. Photosynthesis: Photosynthetic pigments, photosynthetic light reactions, photo-phosphorylation, carbon assimilation pathways: C₃, C₄, and CAM (brief account)
2. Photorespiration and its significance.
3. Translocation of organic solutes: mechanism of phloem transport, source-sink relationships.

UNIT – IV: PLANT METABOLISM (12 hrs)

1. Respiration: Glycolysis, anaerobic respiration, TCA cycle, electron transport system. Mechanism of oxidative phosphorylation.
2. Lipid Metabolism: Types of lipids, Beta-oxidation.

UNIT –V: GROWTH AND DEVELOPMENT (12hrs)

1. Growth and development: definition, phases and kinetics of growth.

2. Physiological effects of phytohormones - Auxins, Gibberellins, Cytokinins, ABA and Ethylene.
3. Physiology of flowering - photoperiodism, role of phytochrome in flowering; Vernalization.

Suggested activity: Seminars, Quiz, Debate, Question and Answer sessions, observing animations of protein biosynthesis in you tube.

Books for Reference:

1. Steward. F.C (1964): Plants at Work (A summary of Plant Physiology) Addison-Wesley Publishing Co., Inc. Reading, Massachusetts, Palo alto, London.
2. Devlin, R.M. (1969) : Plant Physiology, Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi .
3. Noggle, R.& Fritz (1989):Introductory Plant Physiology Prentice Hall of India.
4. Lawlor.D.W. (1989): Photosynthesis, metabolism, Control & Physiology ELBS/Longmans-London.
5. Mayer, Anderson & Bonning(1965): Introduction to Plant Physiology D. Van Nostrand . Publishing Co., N.Y.
6. Mukherjee, S. A.K. Ghosh(1998) Plant Physiology ,Tata McGraw Hill Publishers(P) Ltd., New Delhi.
7. Salisbury, F.B & C.W. Ross (1999): Plant PhysiologyCBS Publishers and Printers, New Delhi.
7. Plummer, D.(1989) Biochemistry–the Chemistry of life ,McGraw Hill Book Co., London, N.Y. New Delhi, Paris, Singapore, Tokyo.
- 9.Day, P.M.& Harborne, J.B. (Eds.,) (2000): Plant Biochemistry. . Harcourt Asia (P) Ltd., India & Academic Press, Singapore.

II B. Sc BOTANY SEMESTRE- IV, Paper-IV: PRACTICAL SYLLABUS**PAPER-IV: Plant Physiology and Metabolism**

Total hours of laboratory Exercises 30 hrs @ 2 per week

Suggested Laboratory Exercises:

1. Osmosis – by potato osmoscope experiment
2. Determination of osmotic potential of plant cell sap by plasmolytic method using leaves of *Rhoeo* / *Tradescantia*.
3. Structure of stomata (dicot & monocot)
4. Determination of rate of transpiration using cobalt chloride method.
5. Demonstration of transpiration by Ganongs' photometer
6. Demonstration of ascent of sap/Transpiration pull.
6. Effect of Temperature on membrane permeability by colorimetric method.
7. Study of mineral deficiency symptoms using plant material/photographs.
8. Separation of chloroplast pigments using paper chromatography technique.
9. Rate of photosynthesis under varying CO_2 concentrations.
10. Effect of light intensity on oxygen evolution in photosynthesis using Wilmott' bubbler.

II B. Sc – SEMESTER- IV, BOTANY PRACTICAL MODEL PAPER
PAPER- IV - Plant Physiology and Metabolism

1. Perform the Experiments A & B. Give the aim, principle, procedure and observation. Tabulate the results if any. Draw labeled diagram. 2 x 15 = 30 marks

2. Give the protocol of the experiments C & D 2 x 5 = 10 marks

3. Record & Viva

10 marks

50 marks

III B. Sc - SEMESTER- V: BOTANY SYLLABUS THEORY PAPER – V

Paper-V: Cell Biology, Genetics and Plant Breeding

Total hours of teaching 60 hrs @ 3 hrs per week

UNIT – I Cell Biology:

(12hrs)

1. Cell, the unit of life- Cell theory, Prokaryotic and eukaryotic cells; Eukaryotic cell components.
2. Ultra structure and functions of cell wall and cell membranes.
3. Chromosomes: morphology, organization of DNA in a chromosome (nucleosome model), Euchromatin and heterochromatin.

UNIT – II Genetic Material:

(12hrs)

1. DNA as the genetic material: Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment.
2. DNA structure (Watson & Crick model) and replication of DNA (semi-conservative)
3. Types of RNA (mRNA, tRNA, rRNA), their structure and function.

UNIT – III Mendelian Inheritance:

(12 hrs)

1. Mendel's laws of Inheritance (Mono- and Di- hybrid crosses); backcross and test cross.
2. Chromosome theory of Inheritance.
3. Linkage: concept, complete and incomplete linkage, coupling and repulsion; linkage maps based on two and three factor crosses.
4. Crossing Over: concept & significance.

UNIT – IV Plant Breeding:

(12 hrs)

1. Introduction and Objectives of plant breeding.
2. Methods of crop improvement: Procedure, advantages and limitations of Introduction, Selection, and Hybridization (outlines only).

UNIT – V Breeding, Crop Improvement and Biotechnology:

(12 hrs)

1. Role of mutations in crop improvement.
2. Role of somaclonal variations in crop improvement.
3. Molecular breeding – use of DNA markers in plant breeding and crop improvement (RAPD, RFLP).

Suggested activity: Seminar, Debate, Quiz, observation of live cells and nucleus in Onion peels, observation of Meiotic nuclei in Maize pollen. Solving Genetics problems.

Books for Reference:

1. Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation Blackwell Science, London
2. Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, New York.
2. Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John Wiley and Sons, London.
3. Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai
4. De. Robertis and De Robertis, 1998, Cell and Moleceular Biology, K.M. Vergheseand Company .
5. Sinnott, E.W., L.C. Dunn & J. Dobshansky (1958) : Principles of Genetics (5th Edition) McGraw Hill Publishing Co., N.Y. Toronto, London.
6. Winchester, A.M. (1958) : Genetics(3rd Edition) Oxford & IBH Publishing House, Calcutta, Bombay, New Delhi.
7. Singleton, R.(1963) : Elementary Genetics, D. Van Nostrand Co., Ltd., Inc., N.Y. & Affiliated East West Press (P) Ltd., New Delhi.
8. Strickberger, M.W. (1976): Genetics(2nd Edition) MacMillan Publishing Co., Inc., N.Y., London
9. Watson, J.D. (1977): Molecular Biology of the Gene, W.A. Benjamin, Inc., Menlo Park- California, Reading-Massachusetts, London, Amsterdam, Don Mills, Ontario, Sydney.
10. Gardner,E.J & Snusted, D.P.(1984): Principles of Genetics (7thedition) John Wiley & Sons, N.Y. Chichester, Brisbane, Toronto, Singapore.
11. Lewin, B. (1985) Genes VII Wiley Eastern Ltd., New Delhi, Bombay, Calcutta, Madras, Hyderabad.
12. Allard R.W(1999): The Principles of Plant Breeding, John & Wiley and Sons.
13. Poelman J.M: Breeding Field Crops, Springer.
14. George Acquaaah(2012):Principles of Plant Genetics & Breeding: Wiley-Blackwell.

III B. Sc - BOTANY SYLLABUS SEMESTER- V
Practical Paper-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING

Total hours of teaching 30hrs @ 2hrs per week

Suggested Laboratory Exercises:

1. Study of the structure of cell organelles through photomicrographs.
2. Study of structure of plant cell through temporary mounts.
3. Study of various stages of mitosis using cytological preparation of Onion root tips.
4. Study of DNA packing by micrographs.
5. Study of effect of temperature & organic solvent on permeability of cell membrane.
6. Numerical problems solving Mendel' Laws of inheritance
7. Chromosome mapping using 3 point test cross data.
8. Hybridization techniques – emasculation, bagging (for demonstration only).
9. Field visit to a plant breeding research station.
10. Calorimetric estimation of DNA by diphenylamine method.

III B. Sc – SEMESTER- V, BOTANY PRACTICAL MODEL PAPER
PAPER-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING

1. Perform the Experiment A .Perform squash on onion root tip, prepare the slide, identify at least one division stage. Write the procedure and draw the diagram of reported stage.

1 x 15 = 15marks

2. Give the experimental protocol of the experiments **B**

1 x 10 = 10 marks

3. Solving numerical problems on Mendelian inheritance **C,D**

2x 7 1/2 =15 marks

4. Record & Viva

= 10 marks

50 marks

A-Onion root squash technique

B- Estimation of DNA by diphenylamine method

C&D Numerical problems on Mendelian

Inheritance.

III B. Sc - SEMESTER- V: BOTANY THEORY SYLLABUS
PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY

Total hours of teaching 60 hrs @ 3 hrs per week

UNIT – I. Elements of Ecology **(12 hrs)**

1. Ecology: definition, branches and significance of ecology.
2. Climatic Factors: Light, Temperature, precipitation.
3. Edaphic Factor: Origin, formation, composition and soil profile.
4. Biotic Factor: Interactions between plants and animals.

UNIT– II. Ecosystem Ecology **(12 hrs)**

1. Ecosystem: Concept and components, energy flow, Food chain, Food web, Ecological pyramids.
2. Productivity of ecosystem-Primary, Secondary and Net productivity.
3. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

UNIT – II Population & Community Ecology **(12 hrs)**

1. Population -definition, characteristics and importance, outlines –ecotypes.
2. Plant communities- characters of a community, outlines – Frequency, density, cover, life forms, competition.
3. Interaction between plants growing in a community.

UNIT – IV Phytogeography **(12 hrs)**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Phytogeographic regions of India.
3. Phytogeographic regions of World.
4. Endemism – types and causes

UNIT- V: Plant Biodiversity and its importance **(12 hrs)**

1. Definition, levels of biodiversity-genetic, species and ecosystem.
2. Biodiversity hotspots- Criteria, Biodiversity hotspots of India.
3. Loss of biodiversity – causes and conservation (*In-situ* and *ex-situ* methods).
4. Seed banks - conservation of genetic resources and their importance

Suggested activity :Collection of different soils, studying their texture, observing polluted water bodies, student study projects, debates on man's activity on ecosystem and biodiversity conservation methods, visiting a nearest natural vegetation area. Visit to NGO, working in the field of biodiversity and report writing; to study Honey Bees and plants yielding honey.

Books for Reference:

1. Daubenmire, R.F. (): Plants & Environment (2nd Edn.,) John Wiley & Sons., New York
2. Puri, .G.S. (1960): Indian Forest Ecology (Vol.I & II) Oxford Book Co., New Delhi & Calcutta.
3. Billings, W.B. (1965): Plants and the Ecosystem Wadsworth Publishing Co., Inc., Belmont.
4. Misra, R. (1968): The Ecology work Book Oxford & INH Publishing Co., Calcutta
5. Odum E.P. (1971): Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
7. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
8. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
9. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
10. Kumar H.D. (2000): Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
11. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
12. Chapman, J.L&M.J. Reiss (1992): ecology (Principles & Applications). Cambridge University Press, U.K.
13. Cain, S.A . (1944): Foundations of Plant Geography Harper & Brothers, N.Y.
14. Mani, M.S (1974): Ecology & Biogeography of India Dr. W. Junk Publishers, The Haque
15. Good, R. (1997): The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

**III B. Sc - SEMESTER- V: BOTANY PRACTICAL PRACTICAL
PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

Total hours of teaching 30 hrs @ 3 hrs per week

1. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, psychrometer, rain gauge, and lux meter.
2. Permeability (percolation; total capacity as well as rate of movement) of different soil samples.
3. Determination of soil pH
4. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (4 each)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method
6. Study of Phytoplankton and macrophytes from water bodies.
6. Study of species diversity index of vegetation.
7. Estimation of Primary Productivity of an ecosystem
8. To study field vegetation with respect to stratification, canopy cover and composition.
9. Study of plants included in agro forestry and social forestry.
10. To locate the hotspots, phyto geographical regions and distribution of endemic plants in the map of India.
11. The following practical should be conducted in the Field/lab with the help of photographs, herbarium, Floras, Red data book- Study of endangered plants species, critically endangered plants species, vulnerable plant species and monotypic endemic genera of India.

III B. Sc - SEMESTER- VI: BOTANY PRACTICAL MODEL PAPER
PAPER–VI: PLANT ECOLOGY & PHYTOGEOGRAPHY

1. Study Project under supervision	= 15 Marks
2. Record & Viva-Voce	= 10 Marks
3. Experiment A	= 10 Marks
4. Anatomical adaptations of B (Section cutting)	= 10 Marks
5. Spotters C&D (2x2 1/2)	= 5 Marks

Total =50 Marks	

1. Study Project of a surrounding Ecosystem (terrestrial or aquatic)(plant diversity, animal diversity, human activity, pollution levels, restoration efforts under supervision.
2. Presentation of the project work in Q & A session.
3. **A** -determination of soil porosity/PH/percolation/retaining capacity.
4. **B**- Xerophyte/Hydrophyte anatomical adaptations.
5. **C & D**-anemometer/rain gauze/lux meter.

III B. Sc - BOTANY SYLLABUS SEMESTER- VI

Paper VII : Plant tissue culture and its biotechnological applications

Total hours of teaching 60hrs @ 3hrs per week

Unit I: PLANT TISSUE CULTURE – 1

(12hrs)

1. History of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation.
2. Methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants.
3. Callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.

UNIT-II: Plant Tissue culture -2

(12hrs)

1. Endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique.
2. Production of secondary metabolites.
3. Cryopreservation; Germ plasm conservation.

Unit III: Recombinant DNA technology

(12hrs)

1. Restriction Endonucleases (history, types I-IV, biological role and application); concepts of restriction mapping.
2. Cloning Vectors: Prokaryotic(pUC 18, pBR322,Ti plasmid and Lambda phage, Eukaryotic Vectors (YAC and briefly PAC)
3. Gene cloning (Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning)
4. Construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by complementation technique, colony hybridization.

Unit IV: Methods of gene transfer

(12hrs)

1. Methods of gene transfer- Agrobacterium-mediated, direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment.
2. Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

Unit V: Applications of Biotechnology

(12 hrs)

1. Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance.
2. Genetic modification – transgenic plants for pest resistant (Bt-cotton); herbicide resistance (Round Up Ready soybean); improved agronomic traits - flavrSavr tomato, Golden rice); Improved horticultural varieties(Moon dust carnations)

Books for Reference:

1. Pullaiah. T. and M.V.Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
6. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Suggested Activities: In vitro initiation of callus on artificial medium, seminars on utilization of rDNA technology, debates on applications of Biotechnology (whether it is a boon or bane to the society) studying growth patterns, vegetative characteristics of Bt.cotton and identifying the features of its pest resistance

III B. Sc - BOTANY SYLLABUS SEMESTER- VI
Practical Paper VII : Plant Tissue Culture & Plant Biotechnology
Total hours of teaching 30hrs @ 2hrs per week

1. (a) Preparation of MS medium.
 (b) Demonstration of in vitro sterilization methods and inoculation methods using leaf and nodal explants of Tobacco/ Datura/ Brassica etc.
2. Study of embryo and culture, micro propagation of Banana, somatic embryogenesis, artificial seeds through photographs.
3. Construction of restriction map of circular and linear DNA from the data provided.
4. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, and micro projectile bombardment.
5. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA (optional)
9. Field visit to a lab involved in tissue culture
10. Study project under supervision of lecturer – tissue culture/ genetic engineering

Expected domain skills to be achieved: Ability to prepare artificial nutrient media, preparing independently, applying various sterilization procedures for media, glassware and biological materials, in vitro propagation of Banana callus, morphogenesis--s, clonal propagation methods, isolation of plasmid DNA individually and as a group.

PRACTICAL MODEL PAPER

Paper-VII : Plant Tissue Culture & Plant Biotechnology

Q1. Project report (A)	- 15 marks
Viva-voce on study project	-05 marks
Q2. Identify and write notes on B, C and D (3x4)	-
12 marks B- Tool/instrument/container used in sterilization	
C- Tool/instrument/container used in gene transfer	
D- GM crops (Photographs)	
Q3. Construct restriction map of circular and/ or linear DNA from the data provided –	
08 marks	
Q4. Field report	- 05 marks
Q5. Record	- 05 marks

50 marks

III B.Sc.: BOTANY SYLLABUS SEMESTER- VI
Cluster Electives, CLUSTER–A CLUSTER ELECTIVE, PAPER–VIII-A1

Paper VIII-A1: Biological instrumentation and Methodology

Total hours of teaching 60hrs @ 3hrs per week

Unit -I: Imaging and related techniques: (12hrs)

Principles of microscopy; Light microscopy; Fluorescence microscopy; Electron Microscopy
(a) Flow cytometry (b) Applications of fluorescence microscopy:

Unit- II: pH and Centrifugation: (12 hrs)

pH meter: Principles and instrumentation, Centrifugation: Principles, types of centrifuges, types of rotors, differential and density gradient centrifugation, application.

Unit- III: Spectrophotometry: (12hrs)

Principle involved in Spectrophotometer; Spectrophotometric techniques, Instrumentation: ultraviolet and visible spectrophotometry (single and double beam, double wavelength spectrophotometers), Infrared spectrometers.

Unit- IV: Chromatography: (12hrs)

Chromatographic techniques: Principle and applications – Column - thin layer –paper, affinity and gaschromatography - Gel filtration - Ion exchange and High performance liquid chromatography techniques– Examples of application for each chromatographic system - Basic principles of electrophoresis.

Unit-V:Preparation of molar, molal and normal solutions, buffers, the art of scientific writing (12hrs)

Understanding the details on the label of reagent bottles.Molarity and normality of common acids and bases.Preparation of solutions.Dilutions.Percentage solutions.Molar, molal and normal solutions.

Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling. The art of scientific writing and presentation of scientific matter.Scientific writing and ethics.Writing references.Powerpoint presentation.Poster presentation. Introduction to copyright-academic misconduct/plagiarism in scientific writing.

Suggested Readings:

1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd.
2. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press.
3. K. Wilson and KH Goulding. 1986. Principles and techniques of Practical Biochemistry. (3 edn) Edward Arnold, London.
4. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
6. Ruzin, S.E. (1999). Plant micro technique and microscopy. Oxford University Press, New York, U.S.A.

Suggested activities: Preparing various laboratory reagents, operating laboratory instruments, noting instrument readings, calculating results accurately, Skills on writing scientific articles, presentation of scientific results through tables, graphs, poster presentations and practicing power point presentations.

Paper VIII-A1: PRACTICAL SYLLABUS

1. Microscopy – Light microscopy: principles, parts & function
2. Micrometry- principle and measurement of microscopic objects: Low power and high power.
3. Camera Lucida drawing with magnification and scale.
4. Principle and working of phase contrast microscope
5. Principle & operation of Centrifuge
6. Preparation of standard acid and alkali and their standardization.
- b) Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions
7. Study of principle and working of pH meter and Measurement of pH of Milk, Pepsi, Lemon juice etc. using pH paper and pH meter
8. Study of principle of Chromatography and separation of amino acids mixture By ascending Paper Chromatography
7. Principle & operation of Colorimeter
8. Principle & operation of Spectrophotometer
9. Chromosome banding, FISH, chromosome painting

9. Principle and technique of TLC (demonstration)
10. TLC separation of Amino acids from purified samples and biological materials
(demonstration)
- 11 PCR - The Polymerase Chain Reaction (protocol) -demonstration
13. Study visit to an institute /laboratory

Domain skills expected to achieve:

Skill in operating laboratory equipment, their upkeep, and adept at various biological techniques. Ability to prepare molar, molal, normal solutions and solutions of different dilutions. Interpreting scientific results, and ability to present results in a scientific way through graphs, photographs, poster presentations and power point presentations.

Paper VIII-A1: Theory: Biological instrumentation and Methodology

PRACTICAL MODEL PAPER

1. Perform the experiment (A). Write the protocol of the experiment - 15 marks
2. Measure the pH of given sample (B) using pH paper and pH meter. Write the procedure and observation. 10 marks
3. Identify C, D, and E. Write the principle and use of them. 3X5 -15 marks
4. Viva voce on Field visit 05 marks
5. Record 05 marks

Key

- A. Amino acid separation by paper chromatography
 - B. Milk, Pepsi, Lemon juice etc
 - C. Camera Lucida/ Micrometer/phase contrast microscope
 - D. Colorimeter/ Spectrophotometer
 - E. Chromosome banding, FISH, chromosome painting
-

III B.Sc.: BOTANY SYLLABUS SEMESTER- VI PAPER – VIII-A2

Paper VIII-A2: Mushroom Culture and Technology

Total hours of teaching 60hrs @ 3hrs per week

Unit I: Introduction, history: (12hrs)

Introduction - history - scope of edible mushroom cultivation, Types of edible mushrooms available in India –*Volvariellavolvacea*, *Pleurotuscitrinopileatus*, *Agaricusbisporus*. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.

UNIT II:Pure culture-spawn preparation: (12hrs)

Pure culture - preparation of medium (PDA and Oatmeal agar medium)sterilization - preparation of test tube slants to store mother culture – culturing of *Pleurotus* mycelium on Petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

Unit III: Cultivation Technology: (12hrs)

Infrastructure: Substrates (locally available) Polythene bags, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag.

Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, composting technology in mushroom production.

Unit IV:Storage and nutrition : (12hrs)

Short-term storage (Refrigeration - up to 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins.

Unit V:FoodPreparation: (12hrs)

Types of foods prepared from mushrooms; soup,cutlet omlette, samosa, pickles and curry .ResearchCentres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested activities: Growing spawn on laboratory prepared medium in petriplates and maintaining, preparing compost and compost beds, packing of beds, spawning, maintaining moisture, picking, blanching and packing. Collecting naturally growing mushrooms and identifying them properly,visits to mushroom houses.

Suggested Readings:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co.Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
5. Biswas, S., M. Datta and S.V. Ngachan. 2011. Mushrooms: A Manual For Cultivation. PHI learning private Ltd., New Delhi, India.
6. Chang, S. and P.G. Miles. 2004. Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact. CRC Press. USA.
7. Miles, P.G. and S. Chang. 1997. Mushroom Biology: Concise basics and current developments. World Scientific Publishing Co. Pte.Ltd. Singapore.

Paper VIII-A2: PRACTICAL SYLLABUS

1. Identification of different edible and poisonous mushrooms.
2. Microscopic and anatomical observations of different mushroom species.
3. Pure culture - preparation of medium (PDA and Oatmeal agar medium) sterilization.
4. Isolation and preparation of spawn under controlled conditions (preparation of mother spawn in saline bo
5. Types of Compost preparation and sterilization.
6. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves/waste.
7. Inoculation and spawning of compost.
6. Incubation and harvesting of mushrooms (collection, drying and preservation).
7. Diseases of mushrooms (photographs).
8. Post-harvest technology steps (photographs).
9. Study tour to mushroom cultivation farms
11. Project work – cultivation of paddy straw/ oyster/white button mushrooms.

Domain skills expected to achieve: Identification of different edible species, skill in media and substrate preparation, isolation of pure culture for spawn, compost preparation, and practices in growing methods of different cultivated mushrooms, Postharvest handling and packing

SCHEME OF PRACTICAL EXAMINATION

PAPER – VIII-A2 (Cluster Elective): Mushroom Culture and Technology

PRACTICAL- VIII-A2: Cluster Elective (MODEL QUESTION PAPER)

Time: 3hrs

Max. Marks: 50

I. Prepare the culture medium for isolation of spawn and make the slants. Write the protocol for preparation of the medium (A)

20 marks

II. Write the protocol for preparation of compost (B)

08 marks

III. Comment on given specimens C, D and E
3x4 = 12 marks

IV. Report on Field visit

05 marks

V. Practical Record

05 marks

Total =

50 marks

KEY

A-PDA /Oatmeal agar
medium B- Paddy straw
compost

C – Edible mushroom (Photograph)

D- Poisonous mushroom (Photograph)

E. Preservation technique (Photograph)

III B.Sc.: Botany Syllabus Semester- VI, PAPER – VIII-A3 (Cluster Elective)

Paper VIII-A3: Internship/ Project Work preferably either in an Institute or Industry

GUIDELINES FOR EVALUATION OF PROJECT WORK

Guidelines for evaluation of project work may include the following:

1. Nature of project
2. Quality of work report and final outcome
3. Presentation/ Viva-Voce

For each component to be evaluated and weightages to be assigned to each component are given in table below for awarding sessional marks:

S. No	Items	Maximum Weightage
1.	Nature of project <ul style="list-style-type: none"> ➤ Relevance (5%) ➤ Novelty/ originality (5%) ➤ Degree of challenges involved (5%) 	15%
2.	Quality of work report and final outcome. a. Quality of work : General appearance, binding and neatness; Utility/feasibility for practical applications: Organization and presentation of text; language and style; quality of diagrams/ graphs etc. ; accuracy in drawing conclusions; cross references; bibliography; suggestions for further work. b. Quality of final outcome: Aesthetics; functionality; user friendliness; cost effectiveness	20% 30%
3.	Presentation/ Viva-Voce <ul style="list-style-type: none"> ➤ Understanding of concepts principles, practices, design considerations, results, implications etc. (15%) ➤ Communication skills (10%) ➤ Viva-Voce skills (10%) 	35%

B

B.Sc - BOTANY
SEMESTER-V/VI: THEORY MODEL PAPER
(General Model Paper)

Time: 3 Hours

Max. Marks:75

SECTION-A (Short Answer Questions)

*(Instructions to the paper setter: Set minimum ONE question from each unit, maximum **Eight** from all.)*

Answer any five of the following question

5x5=25M 1.

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

SECTION-B (Essay Questions)

*(Instructions to the paper setter: Set minimum **two** questions from each unit, either or internal choice)*

Answer All of the following questions

5x10=50M

9. a)

Or

from unit I

b)

10. a)

Or

from unit II

b)

11. a)

Or

from unit III

b)

12. a)

Or

from unit IV

b)

13. a)

Or

from unit V

b)

INTERNAL EXAMS**- 25Marks****(15 marks for unit tests, 5 marks for assignments and remaining 5 marks for seminar etc.)**