

SYLLABUS FOR B.Sc. Botany (Honours) & General

THE UNIVERSITY OF BURDWAN

**[W.e.f.: B.Sc. Part I: Academic Session: 2010-2011; Part II: Academic Session: 2011-2012
& Part III: Academic Session 2012-2013]**

HONOURS:

Part I : 200 marks
Theory : 125 marks
Practical : 75 marks

Part II: 200 marks
Theory : 125 marks
Practical : 75 marks

Part III: 400 marks
Theory : 250 marks
Practical : 150 marks

Duration of Theory Examinations : 4 Hours for 75 & 100 Marks and 2 Hours for 50 Marks

Duration of Practical Examination : 6 Hours

GENERAL:

Part-I : 100 marks
Theory : 100 marks

Part – II: 200 marks
Theory : 100 marks
Practical : 100 marks

Part–III: 100 marks
Theory : 65 marks
Practical: 35 marks

Duration of theory examinations: 3 Hours for 100 marks & 65 marks

Duration of practical examinations: 6 Hours for 100 marks & 3 Hours for 35 marks

SYLLABUS FOR B.Sc. BOTANY (Hons)

THE UNIVERSITY OF BURDWAN

PART-I		THEORY	PRACTICAL PAPER-III (TOTAL-75)
PAPER-I F.M – 75			Marks
	ALGAE	30 [24 lec. hrs]	17
	FUNGI	25 [20 lec. hrs]	16
	PATHOLOGY	20 [16 lec.hrs.]	10
PAPER-II F.M -50			
	BRYOPHYTA	15 [12 lec.hrs.]	12
	MORPHOLOGY & ANATOMY	35 (18 + 17) [15+13 lec.hrs.]	20
PART-II		THEORY	PRACTICAL PAPER VI F. M.-75
PAPER-IV F.M – 75			
	PTERIDOPHYTA	30 [24 lec.hrs.]	20
	GYMNOSPERMS	30 [24 lec. hrs.]	20
	PALAEOBOTANY	15 [12 lec. hrs.]	10
PAPER-V F.M – 50			
	TAXONOMY	35[28 lec. hrs.]	25
	PLANT GEOGRAPHY	15 [12 lec. hrs.]	
PART-III		THEORY	PRACTICAL PAPER X (TOTAL 75)
PAPER VII F.M -100			Marks
	MICROBIOLOGY	30 [24 lec.hrs.]	CELL BIOLOGY - 30
	ECONOMIC BOTANY & PHARMACOGNOSY	25 [20 lec.hrs.]	GENETICS & PLANT BREEDING- 24
	PALYNOLOGY & REPRODUCTIVE BIOLOGY	15 [12 lec.hrs.]	MICROBIOLOGY – 15 PALYNOLOGY & REPRODUCTIVE BIOLOGY-06
	ECOLOGY	30 [24 lec.hrs.]	PAPER-XI (TOTAL-75)
PAPER-VIII F.M - 75			Marks
	CELL BIOLOGY & BIOTECHNOLOGY	40 [32 lec.hrs.]	PLANT PHYSIOLOGY - 35
	GENETICS & PLANT BREEDING	35 [28 lec. hrs.]	BIOCHEMISTRY - 20
PAPER-IX F. M.-75)	PLANT PHYSIOLOGY	50 [40 lec.hrs.]	ECOLOGY- 10
	BIOCHEMISTRY	25 [20 lec.hrs.]	PHARMACOGNOSY - 10

PART-I

Paper – I

F. M. – 75

Algae – 30 marks

1. Introduction; habitat and range of thallus structure in algae; origin and evolution of sex in algae.
2. Evolution of thallus structure in algae.
3. Endosymbiosis and evolution of chloroplast in algae.
4. Principles of classification and outline classification of Lee (2009) up to divisions.
5. Cyanophyceae: Salient features, a general account with emphasis on cell structure and reproduction.
6. Chlorophyceae: Salient features; life history of *Chlamydomonas*, *Zygnema*, *Oedogonium* & *Trentepohlia*.
7. Charophyceae: Salient features; life history of *Chara*.
8. Xanthophyceae: Salient features; life history of *Vaucheria*.
9. Bacillariophyceae: Salient features; a general account with emphasis on cell structure and reproduction.
10. Phaeophyceae: Salient features; life history of *Fucus*.
11. Rhodophyceae: Salient features; life history of *Polysiphonia*.
12. Economic importance of algae.

Fungi – 25 marks

1. Introduction, Salient features; Classification [Ainsworth Sparrow Sussman (1973)] and Gwynne-Vaughan & Barnes up to class).
2. Economic importance of fungi.
3. Phycomycetes: Salient features, life histories of *Synchytrium* and *Rhizopus*.
4. Ascomycetes: Salient features, development of *Ascus* and *Ascospores*, types of ascocarps; life histories of *Ascobolus* and *Claviceps*.
5. Basidiomycetes: Salient features; development of Basidium and Basidiospore, life histories of *Agaricus*, *Polyporus* and *Lycoperdon*.
6. Deuteromycetes: Salient features; fruiting structures and parasexuality.
7. Lichen: Habitat and thallus structures; economic importance.

Pathology-20 marks

1. Plant Diseases: Definition; concepts of parasitism and saprophytism, Koch's postulate.
2. Classification of plant diseases based on symptoms.
3. Pathotoxins (HV toxin and Wild-fire toxin) in disease development.
4. Brief ideas on structural and biochemical defense mechanism of plants.
5. Control of Plant diseases: Physical, cultural, chemical and biological.
6. Symptoms, disease cycles and control measures of White rust of crucifer, Loose smut of wheat, Citrus canker, Late blight of potato, Rust of wheat & Brown spot of Rice.

Paper – II

F.M. 50

Bryophyta – 15 marks

1. Introduction, general characters, Classification (Smith, 1955), Economic importance.
2. Life histories of *Riccia*, *Marchantia*, *Pellia*, *Porella*, *Anthoceros*, *Sphagnum* & *Funaria* .
3. Evolutionary trends among the above mentioned genera.

Morphology - 18 marks

1. Leaves: Types, phyllotaxy, modifications of leaves.
2. Inflorescence: Types and evolution.
3. The flower as a modified shoot; aestivation; placentation and its evolution; floral formulae, floral diagram; adhesion and cohesion of floral parts.
4. Fruits: Definition and types
5. Dispersal of fruits and seeds.

Plant Anatomy – 17 marks

1. Cell wall: Structure, growth and thickenings.
2. Tissue: Definition, organization of shoot and root apices, mechanical tissue and their distribution in plant bodies.
3. Stele: Definition, evolution; types of vascular bundles.
4. Root-stem transition.
5. Secondary growth: normal and anomalous types; secondary growth in dicot root and shoot.
6. Anomalous secondary growth in stems of *Bignonia*, *Boerhaavia*, *Dracaena* (*Cordyline*).

Paper – III [Practical]

F. M. – 75

Algae-18 marks

1. Study of the following genera (with camera lucida /drawing prism): *Oscillatoria*, *Gloeotrichia*, *Scytonema*, *Oedogonium*, *Zygnema* & *Trentepohlia*.
2. Identification of all the genera included in the theoretical syllabus (vegetative and reproductive structures).

Fungi – 17 marks

1. Study of the following genera and their identification: *Rhizopus* , *Ascobolus*, *Agaricus*, *Polyporus*.
2. Identification of all the macroscopic and microscopic genera included in the theoretical syllabus (for Deuteromycetes *Alternaria* and *Fusarium* only).

Bryophyta-10 marks

1. Study of the gametophytic and sporophytic structures of the following genera and their identification: *Riccia*, *Marchantia*, *Pellia*, *Porella*, *Anthoceros*, *Sphagnum* and *Funaria*.
2. Identification of the genera included in the theoretical syllabus.

Pathology-10 marks

1. Identification of diseases prescribed in the theoretical syllabus.
2. Study of the following diseases: White rust, Rust of wheat/*Justicia*, loose smut of wheat.
3. Demonstration on isolation and subculturing of pathogen, preparation of media - slants, stabs and plates.

Anatomy and Morphology-20 marks**Anatomy**

1. Study of the secondary structures of stem of the following genera: *Bignonia*, *Dracaena* (*Cordyline*), *Boerhaavia* and *Strychnos*.
2. Microscopic identification of the followings: Bulliform cells, stomatal types, lenticels, glandular hair, acicular raphides, macerated tissue elements of *Polyalthia* and *Pinus* stem.

Morphology

1. Identification with reasons of all the structures mentioned in the theoretical syllabus.

N. B.: Temporary slide preparation of Algae, Fungi, Bryophytes, Anatomy. Submission: Algae-5, Fungi-5, Pathology-5, Bryophyte-2, Morphology: Suitable specimen.

Distribution of Marks for Paper – III (Practical)**Full Marks – 75**

Subject	Workout [marks]	Identification [marks]	Submission [NB, slides & field records] [marks]	Viva voce [marks]
Algae	9	4	2 ½	10
Fungi	9	4	2 ½	
Pathology	5	2	2 ½	
Bryophyte	5	2	2 ½	
Morphology	---	6	2 ½	
Anatomy	5	1	2 ½	
Total	33	17	15	10

PART-II**Paper-IV****F.M.-75****Pterodophyta-30 marks**

1. Introduction to Pteridophyta.
2. Outline of Pichi Sermolii's system (1977) of classification of pteridophytes up to orders mentioning class characters.
3. Telome theory of Zimmerman and Enation theory of Bower.
4. Vegetative and reproductive organography of the following genera: i) *Rhynia*, ii) *Zosterophyllum*, iii) *Psilophyton*, iv) *Lycopodium*, v) *Selaginella*, vi) *Isoetes* vii) *Lepidodendron*, viii) *Calamites*, ix) *Equisetum*, x) *Pteris*, xi) *Marsilea*.
5. Apogamy and apospory in pteridophytes.

6. Economic importance of pteridophytes.

Gymnosperm-30 marks

1. General features, concepts of ovule and seed; outline classification as adopted by Stewart & Rothwell (1993).
2. Progymnospermopsida: General features.
3. Pteridospermales: General account of *Lyginopteris* plant (*Sphenopteris* leaf, *Lyginopteris* stem, *Crossotheca* male organ and *Lagenostoma* female organ).
4. Glossopteridales: General account of *Glossopteris* plant (*Vertebraria* root, *Araucarioxylon* trunk, *Glossopteris* leaf, *Glossotheca* male organ, *Dictyopteridium* female organ).
5. Cycadales: Structure and life history of *Cycas* and its distribution in India.
6. Bennettitales: General account of *Williamsonia* plant (*Bucklandia* stem, *Ptilophyllum* leaf, *Weltrichia* male organ, *Williamsonia* female organ).
7. Pentoxylales: General account of *Pentoxylon* plant (*Pentoxylon* stem, *Nipaniophyllum* leaf, *Sahania* male organ, *Carnoconites* female organ).
8. Ginkgoales: Structure and life history of *Ginkgo*; brief mention of the morphology of collar.
9. Coniferales: Structure and life history of *Pinus*; brief mention of the morphology of ovuliferous scale.
10. Gnetales: Structure and life histories of *Ephedra* and *Gnetum*; their distribution in India.
11. Economic importance of gymnosperms.

Palaeobotany-15 marks

1. Introduction, importance of Paleobotany.
2. Definition of fossil, process of fossilization, types of fossils on the basis of their preservation; concept of Form Genus.
3. Introductory idea of correlation and stratigraphy; stratigraphic deductions based on plant fossils.
4. Age of the earth, Geologic Time Scale, major events of plant life through geologic time.

Paper –V

F.M.-50

Taxonomy-35 marks

1. Definition of Taxonomy (alpha & omega), Taxonomic principles, concept of hierarchy and categories.
2. Definition of Numerical taxonomy; Operational Taxonomic Units (OTU); Phenon,; Phenogram.
3. Outline of the system of classification – Linnaeus (1753), Bentham and Hooker (1862-83), Takhtajan (1997).
4. ICBN and its divisions, Valid publication. Principle of priority. Nomenclatural types.
5. Importance of herbaria and botanical gardens in taxonomic studies.
6. Salient features of the following families with examples from common Indian species and economic importance. [Evolutionary trends need to be briefly discussed in case of families marked with astericks].

Dicotyledons: Magnoliaceae*, Malvaceae, Brassicaceae, Fabaceae (Leguminosae), Euphorbiaceae, Apiaceae (Umbelliferae), Apocynaceae, Asclepiadaceae, Solanaceae, Scrophulariaceae, Lamiaceae (Labiatae), Verbinaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Asteraceae(Compositae)*.

Monocotyledons: Alismataceae*,Liliaceae, Poaceae, Musaceae, Orchidaceae*.

Plant Geography – 15 marks

1. Phytogeographical classification of India (D. Chatterjee- 1962).
2. Vegetation characteristic of Eastern Himalayas and Sunderbans.
3. Endemism : Definition and types.

Paper –VI

F.M.-75

Pteridophytes-20 marks

1. Study of external morphology and anatomical features of leaf, stem and reproductive parts of the following:
Lycopodium, Selaginella, Equisetum, Pteris and Marsilea.
2. Macroscopic and microscopic identification of specimens of all extant genera included in the theoretical syllabus,

Gymnosperms & Palaeobotany- 30 marks

1. Study of the morphological and anatomical features of the following: *Cycas* (leaflet, rachis, microsporophyll), *Pinus* (needle, stem, male cone), *Ephedra* (stem, male and female cones).
2. Macroscopic and microscopic identification of specimens of all the extant genera included in the theoretical syllabus.
3. Study (including mode of preservation) of the following: *Lepidodendron*, (stem in T. S.), *Calamites* (stem in T. S.), *Bucklandia* (stem, specimen), *Glossopteris* (leaf, specimen), *Lyginopteris* (stem in T. S.), *Vertebraria* (root, specimen).

Taxonomy of Angiosperms-25 marks

1. Study of the morphology of locally available plants of the families included in the theoretical syllabus including floral formula and floral diagrams, identification up to genus following published keys (Bengal Plants by David Prain 1903).

N. B.: 1) One excursion compulsory.

- 2) Submission: Herbarium specimen only – Pteridophyte-2, Gymnosperm-2, Angiosperms herbarium-10.
- 3) Field note book with photographic documents.
- 4) Temporarily prepared slides (Pteridophytes and Gymnosperms).

In respect of practical paper VI excursion/field trips are to be organized in botanically rich areas. In view of the necessity to conserve biodiversity for each of the practical papers, the number of specimen to be submitted in the examination should be within the limit of minimum 30 and maximum 50. During evaluation more emphasis would be given to Field Records and quality of preservation.

Distribution of marks of Paper VI (Practical)**Full Marks - 75**

Subject	Workout [marks]	Identification [marks]	Note book [marks]	Submission of pteridophytes & gymnosperms and slides [marks]	Herbarium of angiosperm & field record [marks]	Viva –voce [marks]
Pteridophytes	10	2 marks x 2 [micro + macro] = 4	2	03		09
Gymnosperms	10	2 x 2 [micro + macro] = 4	2			
Palaeobotany	--	3 marks x 2 = 6	2			
Taxonomy	12	1 ½ marks x 4 = 6	2		03	
Total	32	18	8		03	

PART-III**Paper –VII****F.M.-100****Microbiology-30 marks**

1. Bacterial structure and function. Capsule, flagella, pili, cell wall (chemical composition and characteristics), plasma membrane, ribosomes, cytoplasmic inclusions (PHB, Volutin). Plasmids and bacterial chromosome, endospore.
2. Principles and modern approaches of bacterial Taxonomy, brief outline of Prokaryotic classification (Bergey's Manual of systematic Bacteriology, 2nd edition, 2001), Concept of Bacteria and Archaea.
3. Economic importance of microorganisms i) Agricultural Microbiology (Biofertilizer, biopesticides), ii) Industrial Microbiology (in fermentation and Pharmaceuticals), iii) Medical Microbiology (air borne – Influenza; Water borne – Cholera; Food borne – Botulism; Brief idea about epidemiology, causal organism and control).
4. Brief idea about genetic recombination in bacteria: Transformation, Conjugation and Transduction.
5. Viruses: General concept, nature of viruses, structure of TMV, T₂ and HIV; Viral multiplication – Lytic and Lysogenic cycles.
6. Brief idea about Prion and Viroid.

Economic Botany & Pharmacognosy-25 marks

1. Method of cultivation, processing and utilities of the products of the following: Rice, Tea and Jute.
2. Morphological nature and major uses of the economically important parts of the following products: Cotton (fibre), Sal (wood), Sugarcane (sugar), Mustard (oil) and Coconut (oil).
3. A brief idea about pharmacognosy; definition of drugs, folk medicine, active principles; Pharmacy, Pharmacognosy, Pharmacopeia and adulteration.
4. Study of the following drug plants (Diagnostic features, active principles and uses): *Rauwolfia serpentina* (root), *Adhatoda vasica* (leaf), *Strychnos nuxvomica* (seed), *Cinchona succirubra* (bark).

Palynology and Reproductive Biology-15

1. Microsporogenesis ; Spore/pollen morphology with reference to polarity, size, shape, symmetry, aperture and sculpture.
2. Organization of orthotropous ovule, types of ovules; megasprogenesis.
3. Pollination: Types and contrivances.
4. Development of male and female gametophytes (*Polygonum* type)
5. Fertilization.
6. Endosperm: Types, development of free nuclear type.
7. Development of typical dicot embryo (Crucifer - type).

Ecology-30 marks

1. Ecology: Autecology and Synecology (definition only).
2. Environment: Climatic, edaphic and biotic factors.
3. Ecosystem: Definition, concept of ecological pyramids and energy flow.
4. Ecological succession (Hydrosere, Xerosere).
5. Morphological, anatomical and physiological adaptations of xerophytes, hydrophytes, halophytes and epiphytes.
6. Biodiversity (a brief idea) and its conservation (*in-situ*-, *ex-situ* conservation and cryopreservation).
7. Pollution: Definition and types with special reference to air and water pollution.

Paper VIII

(Total 75)

Cell Biology & Biotechnology - 40 Marks

1. Cell structure: Ultrastructure and functions of Plasma membrane, Mitochondrion, Chloroplast, Nuclear envelope with nuclear pore complex, Golgi apparatus, Endoplasmic reticulum and Ribosome.
2. Nucleic acid: DNA and RNA – Types, Physical and Chemical structures of B-DNA and t-RNA.
3. Replication of DNA - Mechanism and evidence of semi-conservative replication in prokaryotes.
4. Transcription of DNA: Mechanism in Prokaryotes; Nuclear mRNA processing in Eukaryotes (Capping, Polyadenylation or tailing and Splicing).
5. Translation: Mechanism in Prokaryotes.
6. Genetic code: Definition, salient features and deciphering the genetic code.
7. Gene regulation in Prokaryotes: Lac operon (negative and positive control).
8. Eukaryotic chromosome structure: Ultrastructure of chromatin and its organization into chromosome, Concept of euchromatin and heterochromatin.
9. Cell cycle and its regulation (MPF only), phases and events of Mitosis and Meiosis with their significance.
10. Brief idea: Transposable elements, Gene amplification (PCR), Transgenic plant (Bt cotton).
11. Recombinant DNA Technology: Basic concepts; Tools - Restriction enzymes (types with examples); Lygase; Vectors (Plasmid and Bacteriophage).
12. Plant tissue culture: General techniques, concept of Basal medium, Micropropagation, Application of Plant tissue culture.

Genetics & Plant Breeding- 35 Marks

1. Mendelism and Chromosomal basis of inheritance.
2. Modified Mendelian Ratios: Lethal gene, Epistasis and Complementary gene interaction.
3. Basic concept of Linkage: General idea of Crossing over including molecular mechanism (Holiday Model).
4. Structural changes of chromosome (Deletion, Duplication, Translocation and Inversion) with their meiotic behavior and genetic consequences.

5. Numerical changes of chromosome (Euploidy and Aneuploidy) and their applications.
6. Gene mutation- types, physical & chemical mutagens and their effects.
7. Aims and methods of Plant breeding: Introduction, Acclimatization, Domestication, Selection and Hybridization.
8. Heterosis: Objectives, genetic basis and applications.
9. Biometry: Frequency distribution - mean, median, mode, class range, standard deviation and standard error. Probability: product law, Sum law, conditional probability, Chi-square test of goodness of fit;

Paper –IX

F.M.-75 marks

Plant physiology - 50 marks

1. Water relation: Role of water in plant life. Water potential and its components in plant cell, soil water absorption, cavitation in xylem and embolism, Transpiration types and mechanism of stomatal transpiration (the roles of CO₂, blue light, potassium ion and abscisic acid), Antitranspirants.
2. Mineral nutrition: Essential elements and their physiological roles in plant life. Mechanism of active ion uptake.
3. Organic translocation: Phloem loading and unloading mechanism, long distance transport (Pressure flow hypothesis).
4. Photosynthesis: Definition, photosynthetic pigments, basic concept about mechanism of light and dark reaction. C₃ -, C₄ - and CAM pathways of CO₂ fixation. Photorespiration - definition, sites and mechanism.
5. Respiration: Glycolysis, Krebs cycle, electron transport system, oxidative phosphorylation and chemiosmotic system.
6. Nitrogen metabolism, nitrate reduction, (nitrate reductase, nitrite reductase), nitrogen fixing organisms (free living, symbiotic and associative symbiotic organisms). Mechanism of nitrogen fixation – asymbiotic, symbiotic with special reference to nitrogenase and leghaemoglobin; nitrogen cycle.
7. Growth physiology: Concept of growth and development, factors affecting growth. Phytohormones - types and chemical nature of Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene; physiological roles; bioassay of IAA and GA₃; an idea about immunoassay and radio immunoassay (RIA) of phytohormones.
8. Concept of photoperiodism and vernalization. Phytochrome - chemical nature, photobiological properties and role in flowering.
9. Seed physiology: Concept of dormancy, quiescence and germination. Dormancy - types, causes, significance, breaking of dormancy. Germination – a basic concept.

Biochemistry - 25 marks

1. Carbohydrates: Outline classification, reducing and non-reducing sugars. Structures of mono-, di- and polysaccharides, properties of monosaccharides.
2. Amino acids: Basic structure and outline classification with examples.
3. Protein: Primary, secondary (α - helix & β -pleated sheet), tertiary and quaternary structures.
4. Lipid: Structure of fatty acids, types, outline classification; β -oxidation pathway.
5. Enzymes: Definition, co-factors and prosthetic group with examples. Nomenclature and classification of enzymes (IUB system, 1961). Preliminary idea about the mechanism of enzyme action and kinetics, factors affecting enzyme action, Ribozyme, allosteric enzyme, abzyme.

PRACTICAL**A. Cell Biology, Genetics & Plant Breeding - 54 marks**

1. Study of mitotic cell division and chromosome complement in *Allium cepa* by aceto-orcin squash technique.
2. Determination of mitotic index in *Allium cepa* root tip by aceto-orcin squash technique.
3. Study of meiotic division in *Allium cepa* and *Rhoeo spathacea / discolor* by aceto carmine staining technique.
4. Testing of goodness of fit with Mendelian mono- and dihybrid ratios.

B. Microbiology - 15 marks

1. Aseptic method
 - a) Sterilization technique by Autoclaving, Hot air oven and surface sterilization.
 - b) Preparation of standard bacteriological medium (Nutrient agar, Nutrient broth and glucose – peptone medium).
 - c) Preparation of slant and plates.
 - d) Subculturing of pure bacteriological culture.
 - e) Pure culture technique: dilution streak method.
2. Microscopic examination of bacteria from natural habitats: curd and root nodules of leguminous plants.
3. Differential staining: Gram staining.

C. Palynology & Reproduction Biology - 6 marks

1. Pollen morphological studies of *Impatiens* and *Hibiscus* pollens form prepared slides.

Distribution of marks:

- | | |
|--|----|
| 1. Study of mitotic cell division/ chromosome complements/ mitotic index in <i>Allium cepa</i> . | 12 |
| 2. Study of meiotic cell division in <i>Allium cepa</i> . | 12 |
| 3. Testing of goodness of fit with Mendelian mono- and di-hybrid ratios. | 10 |
| 4. Slide preparation from curd/ root nodules by Gram staining. | 10 |
| 5. Identification from slides (mitosis, meiosis, palynology (3 marks x 3)). | 9 |
| 6. Practical note books. | 9 |
| 7. Permanent slide submission. | 3 |
| 8. Viva-voce | 10 |

PRACTICAL**Plant Physiology – 35 marks**

1. Preparation of percent, normal, molal and molar solutions of any compound.
2. Determination of isotonic concentration and osmotic pressure of cell sap by plasmolytic method.
3. Comparison of imbibition of starchy, proteinaceous and fatty seeds.
4. Determination of amount of water absorption, retention and transpiration.
5. Determination of transpiration rate and effect of environmental factors (Humidity and light).
6. Determination of the effect of KNO_3 solution on stomatal opening.
7. Determination of the rate of respiration of different plant parts using Ganong's respirometer or respiroscope.
8. Determination of RQ of different types of seeds using Ganong's respirometer or respiroscope.
9. Determination of the effect of CO_2 concentration on the rate of photosynthesis using molar solution of bicarbonate and by measurement of volume of O_2 liberation.
10. Determination of viability of seeds by TTC (TZ) test.

Biochemistry – 20 marks

1. Qualitative detection test for the following compounds: General test for carbohydrates, reducing and non-reducing sugars.
2. Specific tests for glucose, sucrose and starch.
3. General tests for protein.
4. General tests for Calcium, magnesium, iron and phosphorus from plant ash.
5. General tests for organic acids - oxalic, citric, tartaric and malic.

Ecology-10 marks

1. Ecological adaptations of some species: *Ipomoea aquatica* stem, Phyllode of *Acaccia auriculiformis*, *Nerium* leaf and *Vanda* root
2. Quadrat method (minimum size of quadrat, species area curve method and minimum number of quadrats).

Pharmacognosy – 10 marks

1. Identification of plant drug materials (on the basis of salient organoleptic and microscopic features of fresh and powder materials).
a) *Adhatoda* (leaf), b) Ginger (rhizome) and c) *Strychnos* (seeds).

Distribution of marks

- | | |
|---|----------|
| 1. Plant Physiology Experiment(s) [major and minor] | 25 marks |
| 2. Biochemical test(s) | 14 marks |
| 3. Ecological adaptation of some species (<i>Ipomoea aquatica</i> stem/ Phyllode of <i>Acaccia auriculiformis</i> /
<i>Nerium</i> leaf/ <i>Vanda</i> root | 08 marks |
| 4. Identification of plant drug materials (anatomical work of fresh/powder material from
(<i>Ipomoea aquatica</i> stem/ Phyllode of <i>Acaccia auriculiformis</i> / <i>Nerium</i> leaf/ <i>Vanda</i> root | 08 marks |
| 5. Practical note books | 10 marks |
| 6. Viva-voce | 10 marks |

Reference Books

1. College Botany Vol. – I. - Gangulee, Das & Datta, New Central Book Agency. Kolkata.
2. College Botany Vol. –II.- Gangulee and Kar, New Central Book Agency, Kolkata.
3. College Botany Vol. –III. – S. K. Mukherjee , New Central Book Agency, Kolkata.
4. Studies in Botany, Vol. I. - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
5. Studies in Botany, Vol. II. - Mitra, Guha, Choudhury. Moulik Library, Kolkata.
6. College Botany (Practical). Vol. I & II - Santra, Chatterjee, Das, New Central Book Agency.
7. Botany – A. C. Datta, Oxford Univ. Press.

Pharmacognosy:

1. Eames, A. J. and Mc Daniels, L. H. An Introduction of Plant Anatomy. Tata Mc. Graw Hill Company Limited.
2. C. K. Kokate; A. P. Purohit; S. B. Pokhale. Pharmacognosy, Nivli Prakashani
3. Tayler, V. E. 1988. Pharmacognosy
4. Agarwal, V. S. & Ghosh, B. 1985. Drug Plants of India: root drugs. Kalyani Publishers

Algae:

1. The structure and reproduction of algae, Fritsch, F. E. Vol. I (1935), Vol. II. Cambridge University Press
2. Freshwater algae of the United States. Smith, G. M. 1950. Mc.Graw Hill Publishing Company.
3. Introduction to the algae: structure and reproduction. 3rd Edition (1985). Bold, H. C. and Wynne, M. J. Wall. Prentice Hall of India Private Limited.
4. Phycology. 4th edition. Lee, R. E. (2009) Cambridge University Press.
5. An Introduction to Phycology. Van der Hock, D. G. Mann and Johns, H. M. 1995. Cambridge University Press.
6. Botany for degree students. Algae. B. R. Vashistha, A. K. Sinha. V. R. Singha (recent edition).

Fungi & Lichen:

1. Introduction to Fungi. Webster, J. Cambridge University Press.
2. Introduction to Fungi. Dubey, H. C. Vikas Publishing House.
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