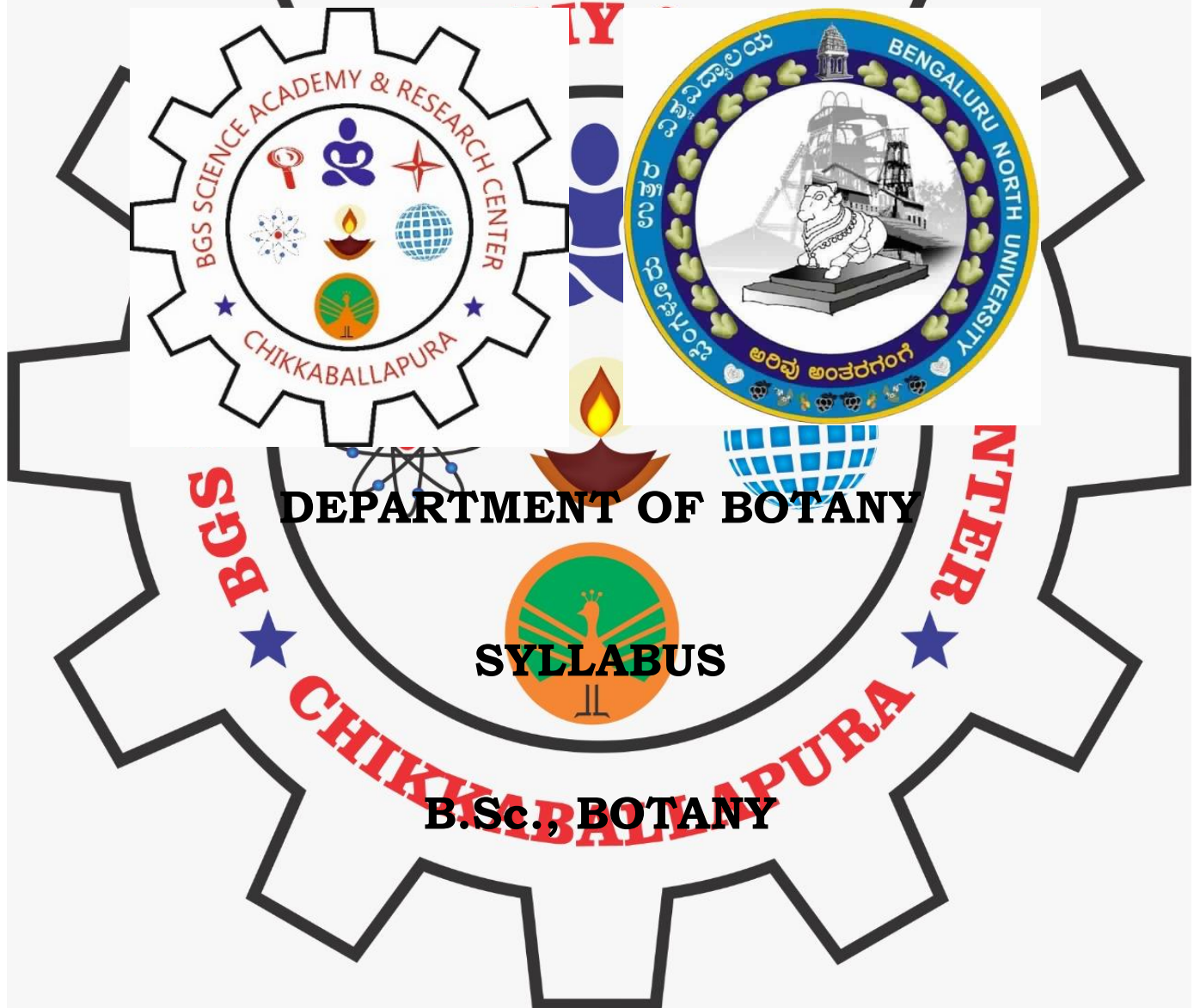


|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust

BGS Science Academy and Research Center

(Affiliated to Bengaluru North University)
Jnanagangothri Campus, Agalagurki, Chikkaballapura-562103.



**QUESTION PAPER FORMAT
THEORY EXAMINATION**

Marks for each question	Number of question to be		Total Marks
	Answered	Out of	
A. 2	10	12	20
B. 5	4	6	20
C. 10	3	5	30
	Total		70

BANGALORE NORTH UNIVERSITY

**B.Sc., Degree Examination
(Undergraduate Credit Based Semester Scheme)**

**BOTANY
ALL PAPER**

Time: 3 hours

Max. Marks: 70

A. Explain / Define any ten of the following in **two** or **three** sentences: (10x2=20)

B. Write critical notes on any **four** of the following (4x5=20)

C. Give a comprehensive account on any **three** of the following (3x10=30)

INTERNAL ASSESSMENT

1. THEORY- 30 MARKS -

Class Attendance = 5 (>51%-1, >61%-2, >71%-3, >81%-4 >90%-5, Long Absent- 0)
 Assignment= 5 (Certificate, content sheet-0.5, Introduction 0.5, description-0.5, pictures or diagrams-1, summary 0.5, references-0.5, correct writing without plagiarism-1 and in time submission -0.5, Absent- 0)
 Seminar = 5 (Presentation: Excellent-5, Good-4, Average-3, Satisfactory-2, Absent- 0)
 Project = 5 (Correct and in time submission-5, Good-4, Average-3, Satisfactory-2, Absent- 0)
 Test = 2 (5 marks each=>85%-5, >70%-4, >55%-3, >35%2, <35%-1, Absent- 0)

2. PRACTICAL- 15 MARKS -

Continues Assessment = 5 (Attendance- 2.5, performance in lab- 2.5)
 Submissions or Maintenance of Plants in the college for lab purpose (2.5) and Regular Record submission (2.5)= 5,
 Test = 5 (>85%-5, >70%-4, >55%-3, >35%2, <35%-1, Absent- 0)

I SEMESTER

PAPER – I: DIVERSITY OF NON-VASCULAR PLANTS

PART-I INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA, CYANOBACTERIA AND PHYCOLOGY

52 hrs

UNIT I: INTRODUCTION TO MICROBIOLOGY AND VIRUSES

13 hrs

Introduction, aim, objectives, scope of microbiology and significance.

Branches of microbiology- Industrial, Medical, Agricultural and Environmental microbiology, Contributions of scientists to the field of microbiology (Anton von Leeuwenhock, Louis Pasteur, Robert Koch, Alexander Flemming)

Isolation of microbes from soil – brief account of culture media, serial dilution, pour plate method and colony characteristics of bacteria.

Applied Microbiology- A brief account of Biofertilizers, Biopesticides, Biogas production, Bioremediation, and Bioconversion of waste products.

A brief history of Virology – (Adolf Mayer, Iwanowsky, Beijerinck, W. M. Stanley, F. W. Twort), General composition and properties of viruses, Architecture of TMV & Bacteriophages, Multiplication & transmission. A brief account of Prions and Viroids

Common plant diseases – Little leaf of Tomato and *Vinca rosea*, Yellow Mosaic of Beans, and Papaya leaf curl

UNIT II: STUDY OF BACTERIA

13hrs

Introduction, Brief account of Bergey's system of bacterial classification. Occurrence, size and shape, arrangement of flagella and structure of Bacterial cell.

Reproduction – Binary fission and genetic recombination. A brief history of plasmids – definition, properties and types, structure and importance of Ti plasmid, bacterial nutrition, phototrophs and chemotrophs.

Economic importance – Role of bacteria in agriculture, medicine and industry.

Bacterial disease – Citrus Canker.

General account of Mycoplasma – Sandal spike disease.

Immunology – Brief account of immune systems, application of immune techniques in agriculture and industry, monoclonal anti bodies (ELISA, Hybridoma techniques).

UNIT III: STUDY OF CYANOBACTERIA AND PHYCOLOGY – PART-I

13hrs

Cyanobacteria: Introduction, general characteristics, outlines of classification, thallus structure, ultra-structure of cell, photosynthesis, reproduction, economic importance of Cyanobacteria, SCP, Biofertilizers, role in water pollution and treatment.

Type study: *Anabaena*, *Spirulina*, *Scytonema*

Phycology-Part-I: Introduction, general characteristics, outlines of classification (Fritsch – 1947), thallus structure, pigmentation, reproduction. Economic importance of algae in industry, agriculture and medicine. Toxic algae – Algal blooms, fish poisoning.

UNIT IV: PHYCOLOGY, PART –II

13hrs

Occurrence, structure, reproduction and life cycle: *Chlamydomonas*, *Hydrodictyon*, *Oedogonium*, *Chara*, *Sargassum* and *Polysiphonia*.

PRACTICAL PAPER – I DIVERSITY OF NON-VASCULAR PLANTS

INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA, CYANOBACTERIA

AND PHYCOLOGY

Total Units - 13

1. Study of instruments: autoclave, inoculation chamber, hot air oven, incubator and inoculation loop. **1 unit**
2. Sterilization of glass ware and media preparation (Nutrient Agar, Martin Rose Bengal Agar). Isolation of Bacteria from soil by pour plate method. **1 unit**
3. Colony characteristics of Bacteria to identify colonies obtained. **2 units**
4. Bacterial diseases – Tomato Leaf curl disease, citrus canker, Mycoplasma- sandal spike
5. Plant viral diseases- Little leaf of Tomato and *Vinca rosea*, Yellow Mosaic of Beans, and Papaya leaf curl **1 unit**
6. Gram staining: a) *Rhizobium* from root nodules b) *Lactobacillus* from curds. **1 unit**
7. Measurement of cell concentration- yeast cells/fungal spores using Haemocytometer. **1 unit**
8. Type study of Cyanobacteria: *Anabaena*, *Spirulina*, *Scytonema* **1 unit**
9. Type study of algae: *Chlamydomonas*, *Hydrodictyon*, *Oedogonium*, *Chara*, *Sargassum* and *Polysiphonia*. **5 units**

PRACTICAL QUESTION PAPER-I DIVERSITY OF NON-VASCULAR PLANTS

INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA, CYANOBACTERIA

AND PHYCOLOGY

Max Marks – 35

1. Identify given specimens **A, B, C & D** with labeled diagrams and reasons **4x3=12**
 2. Describe colony characteristics of given colony **E** & tabulate your observations. **2**
 3. Prepare temporary slide of **F**, sketch, label and identify with reasons. Leave preparation for evaluation. **5**
 4. Stain given material **G** by gram staining write the procedure and identify with reasons. Leave preparation for evaluation. **3**
- Or**
5. Calculate the population of fungal spores / yeast cells **G** using haemocytometer. **2 x 2 ½ = 5**
 6. Record and Submission **5x3= 8**

SCHEME OF VALUATION

1. Four specimens **A, B, C, D**- two from algae, one from Cyanobacteria and one specimen of diseases / Herbarium. (Identification – **1** mark, labeled diagram with reasons **2** marks)
 2. Colony characters of the given colony **E** – **2** marks.
 3. Specimen **F** from algae - mounting – **2** marks. Identification – **1** mark, sketch with reasons **2** marks)
 4. Specimen **G** – Gram staining (Staining, Procedure and result – each **1** mark).
- OR** Calculation of fungal spores / yeast cells using haemocytometer (Procedure **1** mark, calculation – **2** marks)
5. Two permanent slides **H** & **I** - from algae / Cyanobacteria (Identification – **1** mark, sketch with reasons **1 ½** marks)
 6. a) Record – **5** marks
b) Submission of 3 algae / Cyanobacteria materials – **3** marks

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Web Sites

X <http://www.phycology.net/>

X <http://www.algaebase.org/>

II SEMESTER

PAPER II: DIVERSITY OF NON-VASCULAR PLANTS – PART - II MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY 52hrs

UNIT I: MYCOLOGY 13hrs

Introduction: General characters, occurrence, thallus organization, reproduction and classification. Structure, reproduction and life history of *Albugo*, *Peziza*, *Puccinia* and *Cercospora*.

Economic importance: Role of fungi in Medicine, Agriculture and Industry

Lichens: General account, Structure and reproduction. Ecological and Economic importance.

Mycorrhiza: General account

Saccharomyces - A model genetic organism.

UNIT II: PLANT PATHOLOGY 13hrs

General account of symptoms, pathogen etiology, mode of Infection.

Management of fungal diseases: Koleroga, Coffee rust, Grain smut of Sorghum, Blast disease of Rice, Red rot of Sugarcane.

A brief account of Biopesticides: Neem, *Trichoderma* and *Bacillus thuringiensis*

UNIT III: BRYOPHYTA 13hrs

General characters. Study of distribution, structure, reproduction, classification and alternation of generation in *Marchantia*, *Anthoceros* and *Funaria*

UNIT IV: PLANT ANATOMY 13hrs

Meristematic Tissues: Structure, function, classification, Organization of Apical Meristems: Tunica-carpus theory and Histogen theory.

Secretary Cells and Tissues: Structure, Classification and significance.

Simple and permanent tissues

Vascular tissues: A brief account

Secondary growth: Dicot stem.

Anomalous Secondary growth: A general account (*Dracaena* and *Boerhaavia*)

PRACTICAL PAPER – II

DIVERSITY OF NON-VASCULAR PLANTS MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY Total units - 13 Units

- I. Identification and classification of fungi members included in the theory 3 Units
- II. Demonstration of mushroom cultivation, Study of lichens, Study of Mycorrhiza 2 Units
- III. Study of plant diseases- Koleroga, Coffee rust, Grain smut of Sorghum, Blast disease of Rice, Red rot of Sugarcane. 2 Units
- IV. Study of forms of Bryophytes- *Marchantia*, *Anthoceros* and *Funaria* 3 units
- V. Normal and Anomalous secondary growth in Stem ex. *Tridax*, *Dracaena* stem and *Boerhaavia* stem. 2 Units
- VI. Field visit to study pathogen and host interaction 1 Units
- VII. Report of Field visit. Project report of mushroom cultivation / Application of Bio fertilizers

PRACTICAL QUESTION PAPER - II DIVERSITY OF NON-VASCULAR PLANTS MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY

Time: 3 hours

Max. Marks: 35

1. Identify the specimens **A, B & C** with labelled diagrams and reasons 3x3=9
2. Prepare a temporary Safranin-stained T.S of the material **D** Sketch, label and identify with reasons, leave the preparation for evaluation 4
3. Write critical notes on **E** 2
4. Identify the Slides **F, G, H & I** with labelled diagrams and reasons 4x3=12
5. Record and submission. 5+3=8

SCHEME OF VALUATION

1. Two specimens from Fungi and one from Bryophyta (Identification -1- mark, Labelled diagram with reasons 2 marks)
2. Any one of the following may be given-stem of *Tridax*, *Dracaena* or *Boerhaavia* (Staining and mounting- 2 marks, sketch and labelling- 1 mark, Identification with reasons- 1 mark)
3. One diseased plant/Lichens/Mycorrhiza (Identification-1 mark & critical points 1 mark)
4. Two from Bryophytes, One from Fungi and One from Anatomy (Identification & Classification -2- mark, labelled diagrams with reasons-2 marks)
5. Record & Submission: 3 Herbarium sheets from Plant pathology (marks 5+3)

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III SEMESTER

PAPER - III: PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY 52 hrs

UNIT I: PTERIDOPHYTES

13 hrs

Introduction and general character with classification (As per Sporne). Study of diversity in morphology, anatomy and reproduction of the following groups in representative forms

1. Psilotopsida – Eg: *Psilotum*.
2. Lycopsidea – Eg: *Lycopodium*, *Selaginella*.
3. Filicopsida – Eg: *Marsilea*.

(Developmental stages not required)

Brief account of Stejar evolution, heterospory and seed habit.

UNIT II: PALEOBOTANY

13 hrs

Contribution of Paleobotanist- Birbal Sahnii.

Outline of geological time scale with emphasis on Paleozoic and Mesozoic Era.

Process of fossilization- Compression, Impression and Petrification.

Type Study: *Rhynia*, *Cycadeoidea* and *Pentaxylon*.

UNIT III: ENVIRONMENTAL BIOLOGY

13 hrs

Introduction and scope of Environmental Biology

Ecological Factors: Climatic – Light, Temperature, Rainfall, Wind and Atmospheric humidity

Edaphic factors: Soil Formation, Soil Profile, Soil air, Soil Microorganisms

Soil Erosion: Water and Wind.

Soil Conservation:

Biological – Contour farming, Mulching, Strip cropping, Terracing and Crop rotation.

Mechanical – Basin Listing, Construction of dams

Soil reclamations

Biotic Factors – Positive and negative interactions.

Ecosystem – Concept, Components, Study of marine, Grass land and Crop land Ecosystems.

Ecological Succession – Hydrosere and Xerosere.

Ecological Adaptations – Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.

UNIT IV: ECOSYSTEM MANAGEMENT

13 hrs

Water Shed Management.

Conservation of natural resources:

Over Exploitation of Natural resources – eg: Forest, Afforestation, Social Forestry and Agroforestry

Conservation of plant diversity:

In-situ and *Ex-situ* Conservation – National park, Sanctuaries and

Bio reserves. Role of Seed Bank and Gene Bank

PHYTOGEOGRAPHY

Phytogeographical regions of India, Vegetational types of Karnataka.

PRACTICAL PAPER- III

PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY

Total Units - 13

1. Identification and Classification of Pteridophytes (1. Psilotopsida - Eg: *Psilotum*. 2. Lycoposida - Eg: *Lycopodium*, *Selaginella*. 3. Filicopsida - Eg: *Marsilea*.) **4 units**
2. Paleobotany - Study of specimens and slides (fossil material/slide). **1 unit**
3. Ecological Adaptations - Study of one example for each adaptation. **2 units**
4. Estimation of chloride and dissolved oxygen content in the given sample. **2 units**
5. Study of Quadrat method in Ecology and studying soil sample and analysis of soil sample for structure(texture) pH etc. **3 units**
6. Marking of vegetation types of Karnataka- on Karnataka map and Phytogeographical areas of India. **1 unit**
7. Record & submissions: Submission of 3 slides of free hand sections (Pteridophytes / Ecological Specimens)

PRACTICAL QUESTION PAPER-III

PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY

Time: 3 hours

Max Marks: 35

1. Identify and classify specimen **A & B** giving reasons. **2 x 3 = 6**
2. Identify the slides **C, D, E** with reasons and diagrams. **3 x 3 = 9**
3. Comment on slide/specimen/photocopy/photograph of **F**. **3**
4. Identify and comment on Ecological adaptation of **G** and **H** (vegetation pattern of Karnataka). **2x2 ½ = 5**
5. Estimate the Oxygen / Chloride content of the given sample **I**. **4**
6. Record and Submission. **5+3 = 8**

SCHEME OF VALUATION

1. Pteridophytes - (Identification & classification - **1** mark, Reasons - **2** marks).
2. Pteridophytes - (Identification - **1**mark, Reasons - **1** mark, Diagram - **1** mark).
3. Fossil Material - (Identification - **1** mark, comment - **2** marks)
4. Specimen/Slide / Map - (Identification - **1** mark, comment - **1.5** marks)
5. Estimation - (Conducting experiment - **2** marks, principle, procedure & result- **2** marks)
6. Record and Submission: 3 permanent slides of free hand sections of Pteridophytes and ecological specimens (**5+3 = 8** marks).

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IV SEMESTER

PAPER-IV: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

52 hrs

UNIT I GYMNOSPERMS

13 hrs

General characters and classification. Economic importance of Gymnosperms with reference to wood, essential oils, resins and drugs.

Morphology and Anatomy of vegetative structures- Root, stem and leaf (primary and secondary growth), Reproductive structures (Developmental Stages not required) and life cycles of *Cycas*, *Pinus* and *Gnetum* (Evolutionary significance of *Gnetum*)

UNIT II EMBRYOLOGY OF ANGIOSPERMS - I

13 hrs

Indian botanists and their contributions to Embryology- P. Maheshwari, BGL Swamy. **Structure** - Typical Angiosperm flower, Androecium and Gynoecium

Microsporangium-Development & structure of mature anther, Anther wall layers, Tapetum-types, structure& functions. Sporogenous tissue.

Microsporogenesis Microspore mother cells (mmc), cytokinesis, microspore tetrads

Abnormalities-Pollinia, compound pollen grains.

Micro gametogenesis- Formation of vegetative and generative cells, structure of male gametophyte. Abnormalities - Nemece phenomenon.

UNIT III EMBRYOLOGY OF ANGIOSPERMS - II

13 hrs

Structure of Pistil - Placentation- definition and types.

Megasporangium - Structure of ovule -Integuments (endothelium), Micropyle (Obturator), Nucellus (crassinucellate and tenuinucellate conditions). Types of ovule- Anatropous, Orthotropous, Amphitropous, Circinotropous. Megasporogenesis.

Mega gametogenesis - Types of development of Female gametophyte/embryo sac- monosporic- *Polygonum* type, bisporic-*Allium* type, tetrasporic- *Fritillaria* type. Structure of mature embryo sac- Structure and functions of synergids, egg, central cell and antipodals.

Double fertilization - pollen germination, growth of pollen tube through style (solid and hollow styles), entry of pollen tube into ovule (porogamy, mesogamy, chalazogamy), entry of pollen tube into the embryo sac, pollen tube discharge, syngamy, triple fusion. Significance of double fertilization, post fertilization changes.

Endosperm - Types and its biological importance. Free nuclear (*Areca catechu*, *Cocos nucifera*), cellular (*Cucumis*), helobial types. Ruminant endosperm.

UNIT IV EMBRYOLOGY OF ANGIOSPERMS-III

13 hrs

Embryogenesis- Dicot (*Capsella bursa-pastoris*) and Monocot (*Najas*). Parthenocarp. Polyembryony- definition and types.

Seed - Structure of Dicot and Monocot seed.

PALYNOLOGY- pollen morphology - pollen wall, aperture, shape, size and architecture, NPC system, pollen wall stratification. Applied Palynology - Aeropalynology, Mellissopalynology

EXPERIMENTAL EMBRYOLOGY - Definition, Totipotency, basic steps in plant tissue culture technique. Nutrient media- basic components, composition of MS & White's media.

Tissue culture techniques and their practical applications - Anther culture, Embryo culture, protoplast culture.

Embryology in relation to Taxonomy- egs. *Trapa*, *Exocarpus*

PRACTICAL - IV

GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS Total Units - 13

- 1) Study of materials and permanent slides of Gymnosperms included in Theory **5 units**
- 2) Permanent slides of microsporogenesis and male gametophyte **1 unit**
- 3) Mounting of Pollen grains - *Grass, Mimosa*, Pollinia of *Calotropis* and Pollen germination (hanging drop method) **1 unit**
- 4) Permanent slides of types of ovules, Megasporogenesis & embryo sac development **1 unit**
- 5) Permanent slides of types of placentation—Axile, Marginal, Parietal, basal types. Sectioning of ovary, for any two types of placentation. **1 unit**
- 6) Mounting of embryo- *Tridax* and *Cyamopsis*. **1 unit**
- 7) Mounting of endosperm - *Cucumis*. **1 unit**
- 8) Mini project work in groups of 3-5 students, from the following list. **2 units**

a) Study of pollen morphology of different flowers with respect to shape, colour, pores etc.
b) Pollen germination of different pollen grains and calculate percentage of germination.
c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.
d) Study of placentation of different flowers.
e) Any other relevant study related to Gymnosperms / Embryology.

Mini project work may be carried out in groups of 3-5 students, supervised by the batch in charge. The mini project report, about 5-6 pages (type written), to be prepared in following format and certified by the teacher in charge and HOD to be submitted in practical examination.

1. Introduction
 2. Aim of study
 3. Materials & methodology
 4. Observation
 5. Conclusion,
- Copies to be submitted separately by individual members of the group.

PRACTICAL QUESTION

PAPER-IV GYMNASPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Time: 3 hours.

Max Marks: 35

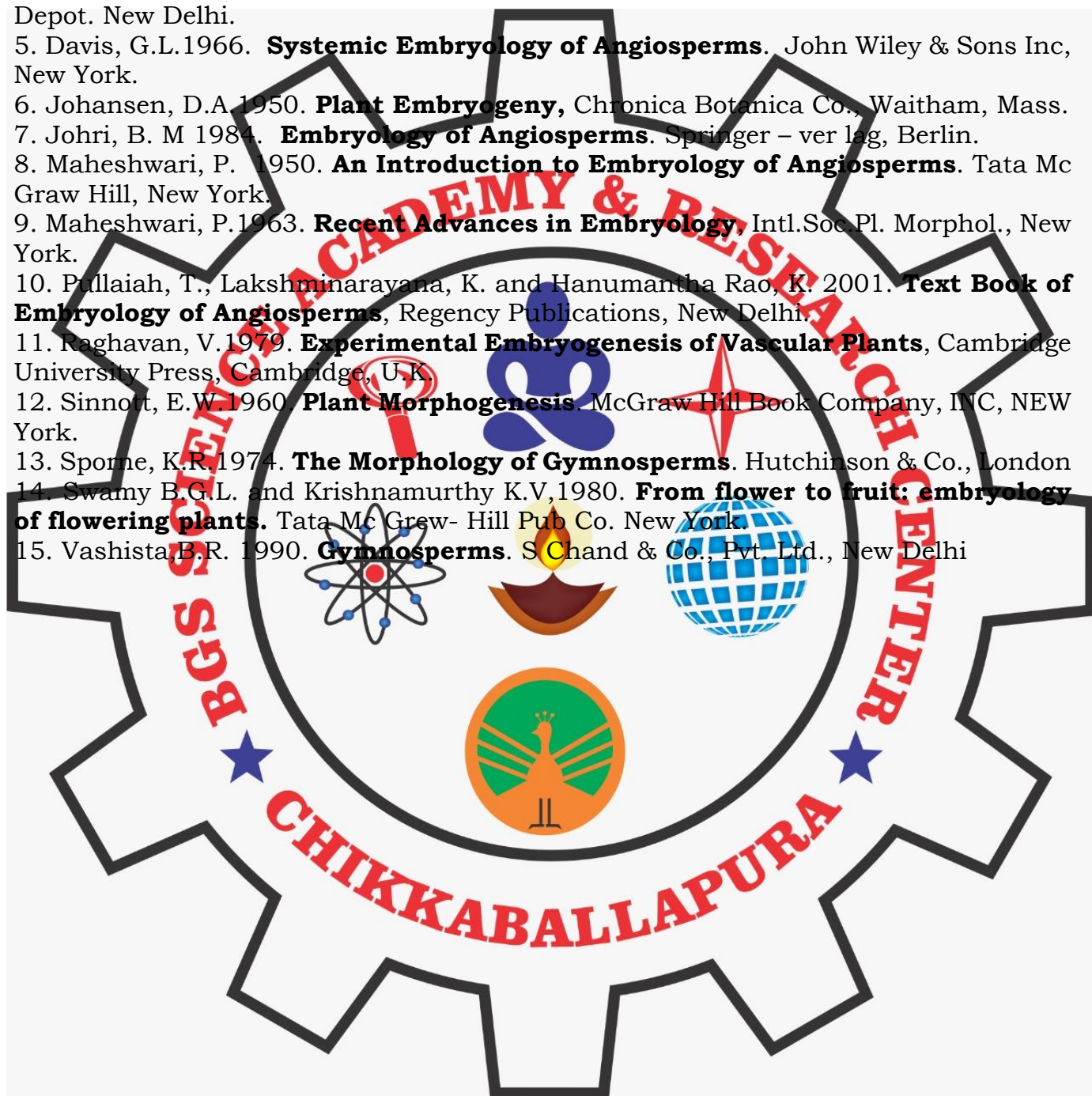
1. Identify and classify specimens **A, B** and **C** giving reasons - **3X3= 9**
2. Identify the slides **D, E** & **F** with reasons and labeled diagrams **3X3=9**
3. Mount the embryo/Endosperm of specimen **G** & comment. **5**
4. Mount the pollinia/perform pollen germination of specimen **H** & comment **4**
5. Record & submission **5+3=8**

SCHEME OF VALUATION

1. Gymnosperm materials- *Cycas, Pinus, Gnetum* (Identification & classification- **1** mark, reasons-**2** marks).
2. One Gymnosperm slide, one from T.S. of young anther/ mature anther, one from megasporogenesis/ stages of embryo sac development, /placentation/ types of ovules included in theory. (Identification - **1** mark, Diagram-**1** mark, reasons- **1** mark).
3. Endosperm /Embryo mounting (preparation- **3** marks, comment with diagram- **2** marks).
4. Pollinia / pollen germination (preparation-**2** marks, comment with diagram- **2** marks)
5. Record & submission of mini project report (**5 + 3** marks)

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V SEMESTER

PAPER-V: TAXONOMY AND ECONOMIC BOTANY

39hrs

UNIT: I CLASSICAL TAXONOMY

13 hrs

Aim and Scope of taxonomy, Brief History, Broad outline of classification proposed by Bentham & Hooker, Engler & Prantl and their relative merits and demerits. Species concept: Taxonomic hierarchy, species, genus and family.

Biosystematics: Plant nomenclature, Binomial system, ICBN- rules for nomenclature. Taxonomic Tools, Herbarium and its techniques, Floras and their importance, Botanical gardens and their importance (one state level, one national level & one international level). (Examples: State: Lalbagh, National: Indian Botanical garden Sibpur, Calcutta, International: Royal Botanical garden, Kew, England). Chemotaxonomy, Cytotaxonomy, Numerical taxonomy & application of computer.

UNIT: II TAXONOMY – I

13hrs

Taxonomic studies of following families, according to Engler & Prantl system of classification and their economic importance

Monocotyledoneae Families: Poaceae, Arecaceae, Musaceae and Orchidaceae

Dicotyledoneae Families: Archichlamydeae- Magnoliaceae, Annonaceae, Brassicaceae, Rutaceae, Leguminosae (Subfamilies: Papilionatae, Caesalpinioideae and Mimosoideae) Rosaceae & Euphorbiaceae.

UNIT: III TAXONOMY – II AND ECONOMIC BOTANY

13hrs

Dicotyledoneae Families: Metachlamydeae- Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Acanthaceae & Lamnaceae.

Ethnobotany: A general account.

ECONOMIC BOTANY: Study of the following plants with Botanical names, Family, parts used, and economic uses.

Edible oils: Groundnut, Coconut & Sesamum

Sugar and Starch: Sugarcane, Beetroot, Potato & Tapioca

Fibers: Cotton, Jute & Coir

Paper & Pulp: Bamboo & Eucalyptus

Beverages: Coffee, Tea & Cocoa

Spices: Ginger, Cardamom, Clove, Cinnamon, Asafoetida, Turmeric, Saffron & Nutmeg

Timber: Teak & Rose wood

Medicinal & Aromatic: Ashwagandha, Aloe vera, Indian Pennywort, Holy Basil, Amla, Periwinkle, Margosa tree, Patchouli, Mint, & Lavender

PRACTICAL PAPER – V TAXONOMY AND ECONOMIC BOTANY

Total Units: 13

1. Morphology of Angiosperms–Vegetative Structure and modifications of root & leaf. **1 Unit**
2. Morphology of Angiosperms – Inflorescence and flower **1 Unit**
3. Morphology of Angiosperms– Fruits (Simple, aggregate & multiple) **1 Unit**
4. Methods of identification of plants with Technical terms. **1 Unit**
5. Study of taxonomic characters of families included in theory (Minimum one genus from each family) **6 Units**
6. Study of economically important plants covered in theory to identify with Botanical names, families, parts used and Economic uses. **2 Units**
7. Herbarium techniques. **1 Unit**
8. Study of local flora by arranging local collection trips.
9. Record & Submission of 6 Herbaria with field notes of plants included in theory.

PRACTICAL QUESTION PAPER- V
TAXONOMY AND ECONOMIC BOTANY

Time: 3 hrs

Max marks: 35

1. Assign the specimens **A, B & C** to their respective families giving diagnostic features. **3×3= 9**
2. Describe **D** in technical terms; draw the floral diagram with floral formula. **6**
3. Identify the specimen **E, F, G, H, I & J** with their morphological, Biological & Economic importance. **6×2=12**
4. Record and Submission. (Herbaria with field notes) **5+3=8**

SCHEME OF VALUATION

1. One Archichlamydeae, one Metachlamydeae, one Monocot (Identification ½ mark, Classification 1-mark, Diagnostic features 1½ mark)
2. Dicot plant (Technical detail 2 marks, floral diagram 2 marks, floral formula 2 marks)
3. Root/ Stem/ Leaf modification/ Inflorescence/ Fruit and/ Economic Importance. (Identification ½ mark, diagram ½ mark, description **1** mark, for economic importance, identification with family **1** mark, part use ½ mark economic uses ½ mark)
4. Record- **5** marks
5. Submission of **Six** herbaria with field notes of family's studies, ½ marks each **3** marks

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V SEMESTER

PAPER VI: MOLECULAR BIOLOGY, GENETIC ENGINEERING, BIOTECHNOLOGY AND PLANT PHYSIOLOGY 39 hrs

UNIT I MOLECULAR BIOLOGY 13 hrs

Introduction, Discovery, Chemical nature & replication of genetic material, genetic code, non genetic RNA, Biosynthesis of proteins, Regulation of gene action in prokaryotes (Lac operon concept only).

GENETIC ENGINEERING & BIOTECHNOLOGY: Steps in Recombinant DNA technology, Genomic libraries, application of genetic engineering technology in agriculture. A brief account on hazards & safeguards of genetic engineering technology with special reference to Bt Cotton. A brief account of Bioinformatics and its uses.

UNIT II MICROBIAL BIOTECHNOLOGY 13 hrs

Uses of microbes in industry and agriculture fermentation – production of ethanol, production of antibiotics – Penicillin.

PLANT PHYSIOLOGY- I – Water Relations: Importance of water, Diffusion, Osmosis, water potential, Osmotic Potential, Membrane and their Permeability. Absorption Of Water- Mechanisms of water absorptions, factors affecting rate of water absorption.

Stress Physiology: Water stress, heat stress, salt stress and mechanisms of Plant response to water and related stress.

UNIT III PLANT PHYSIOLOGY – II 13 hrs

Mechanism of ascent of Sap – Vital and physical force theories. **Transpiration** – Loss of water, Types, Mechanisms, Stomatal Dynamics. Stomatal mechanism, Significance, Factors affecting transpiration, anti -transpirants, Guttation.

Mineral Nutrition In Plants - Major & Minor elements, their deficiency symptoms in plants.

Phloem Transport- Transport of organic solutes. Path of transport, vein loading and unloading Transcellular or streaming hypothesis, contractive protein hypothesis, mass flow hypothesis, Source – Sink concept.

PRACTICAL PAPER-VI

MOLECULAR BIOLOGY, GENETIC ENGINEERING, BIOTECHNOLOGY AND PLANT PHYSIOLOGY

Total Units – 13

- | | |
|--|----------------|
| 1. Qualitative Test for Starch, Protein, Reducing Sugars and Lipids. | 2 Units |
| 2. Determination of Osmotic potential of the cell sap by Plasmolytic method. | 1 Unit |
| 3. Determination of Stomatal Index. | 1 Unit |
| 4. Structures of Stomata in Hydrophytes, Mesophytes and Xerophytes. | 2 Units |
| 5. Streaming of Protoplasm to show Cyclosis. | 1 Unit |
| 6. Determination of pH of Plant Samples by using Indicators. | 1 Unit |
| 7. Study of Osmosis & Transpiration Experiments. | 3 Units |
| 8. Study of Phloem Transport by Ringing Experiment. | 2 Units |

PRACTICAL QUESTION PAPER-VI MOLECULAR BIOLOGY, GENETIC ENGINEERING, BIOTECHNOLOGY AND PLANT PHYSIOLOGY

Time 3 hours

Max. Marks 35

- | | |
|---|------------------|
| 1. Conduct the biochemical test of sample A and B . | 3 x 3 = 6 |
| 2. Determine the osmotic potential of the cell sap by plasmolytic method/ stomatal index of material C | 8 |
| 3. Determine the pH of the given sample D . | 2 |
| 4. Set up and comment on the experiment E . | 6 |
| 5. Comment on experiment F and G . | 4+4 = 8 |
| 6. Record. | 5 |

SCHEME OF VALUATION

1. Samples – Starch, Protein, Reducing Sugar and Lipids (Positive Test - **1** mark, Negative Test – **2** marks).
2. Conducting the Experiment – **3** marks; Principle – **2** marks; Procedure – **1** mark; Result – **2** marks.
3. Extract from Root, Stem, Leaves of a Plant to be given (Determination of pH – **1** mark, Comment – **1** mark).
4. Experiments of **E**: a. Potato Osmoscope. b. Thistle Funnel experiment. c. Farmer's Potometer. d. Ganongs Potometer. (Requirements – **1** mark, Principle – **1** mark, Procedure & Conducting Experiment – **3** marks, Result – **1** mark)
5. Experiments of **F** & **G**: a. Streaming of Protoplasm (Cyclosis). b. Balsam Plant experiment. c. Bell Jar experiment. d. Transpiration Pull. e. Mass Flow Hypothesis. f. Ringing Experiment. (Identification – **1** mark, Comment – **3**)
6. Record **5** marks.

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VI SEMESTER

PAPER-VII: CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING **39 hrs**

UNIT I CELL & CHROMOSOME BIOLOGY **13 hrs**

Cell as a fundamental unit of life and organism. Structure of eukaryotic chromosome; centromere, kinetochore and telomere. Nucleosome and its importance in the organisation of eukaryotic chromosome. Types of Chromosomes; biarmed and holocentric types.

Cell Division- Phases, mitotic apparatus, cytokinesis, mitotic inhibitors, significance of mitosis; Meiosis- phases of meiotic cycle cytological proof of crossing over, synaptonemal complex. Brief study on Apoptosis (PCD)

UNIT II MENDELIAN GENETICS **13 hrs**

Biography of Mendel in brief; Mendel's experiments: Monohybrid cross – law of dominance, law of segregation, purity of gametes. Homozygous, heterozygous, phenotype, genotype, monohybrid test cross, Dihybrid cross-law of independent assortment, dihybrid test cross, incomplete dominance (*Mirabilis jalapa*, Snapdragon).

Modification of Mendelian ratios:(With reference to plant examples). Interaction of genes epistasis (dominant & recessive); supplementary factors, complementary factors. Polygenic inheritance in Maize (Self Sterility in *Nicotiana*), Linkage & Crossing over (in Maize).

SEX DETERMINATION: Chromosomal mechanism of sex determination methods XX – XY, ZZ – ZW & XX – XO (Sex determination in *Melandrium*) and genetic problems related to topics.

UNIT III EVOLUTION **13 hrs**

Big Bang theory, Origin of life, theories of evolution, modern concepts of evolution, role of mutations in evolution, Gene duplication (2R hypothesis), Numerical changes in chromosome number, polyploidy and aneuploidy - trisomics and monosomics and Chromosomal aberrations.

PLANT BREEDING

Historical account and objectives of plant breeding: Vegetative propagation methods (underground plant parts and isolated plant parts - cutting, grafting, layering, gootee, clones) Hybridization (intergeneric and interspecific), maintenance of germplasm, pollen banks, quarantine methods.

PRACTICAL PAPER – VII CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Total Units 13

- | | |
|--|----------------|
| 1. Preparation of cytological stains - Aceto carmine & Aceto orcein. | 1 Unit |
| 2. Mitosis from <i>Allium</i> root tips—Aceto orcein. | 3 Units |
| 3. Meiosis from <i>Allium</i> flower buds—Aceto carmine. | 3 Units |
| 4. Karyotype and Idiogram; Camera Lucida drawing. | 1 Unit |
| 5. Permanent slides of Mitosis. | 1 Unit |
| 6. Permanent slides of Meiosis. | 1 Unit |
| 7. Emasculation and bagging of the flower buds of available species. | 1 Unit |
| 8. Genetic problems. | 2 Units |
| 9. Record and Submission- 6 Slides (3 Mitosis and 3 Meiosis.) | |

PRACTICAL QUESTION PAPER- VII CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Time: 3 hours

Max Marks: 35

- | | |
|---|--------------|
| 1. Prepare a temporary mitotic, slide from material A identify the stage with diagram. | 6 |
| 2. Prepare a temporary meiotic slide from material B identify the stage with diagram. | 6 |
| 3. Identify and comment on C along with a sketch (only Karyotype). | 4 |
| 4. Identify and comment on slides D and E with suitable sketches. | 3+3=6 |
| 5. Solve the Genetic Problem F | 5 |
| 6. Record and Submission | 5+3=8 |

Scheme of Valuation

1. Preparation- **4** marks, identification of stage - **1** mark and diagram **1** mark
2. Preparation - **4** marks, identification of stage - **1** mark and diagram **1** mark
3. Karyotype - slide or sketch, identification-**1** mark, diagram- **1** mark, comment- **2** Marks
4. Slides from meiosis and mitosis identification **0.5** mark, sketch **0.5** mark and comment **2** marks.
5. Genetic problems from
 - i. Dihybrid cross and test cross
 - ii. Incomplete dominance
 - iii. Complementary factors
 - iv. Supplementary factors
 - v. Epistasis - **5** marks
6. i. Record - **5** marks
 - ii. 3 Mitotic and 3 Meiotic permanent slides $\frac{1}{2}$ mark each - **3** marks

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VI SEMESTER
PAPER –VIII: PLANT PHYSIOLOGY – III

39 hrs

UNIT I ENZYMES

13 hrs

Nomenclature, classification, chemical composition, prosthetic groups coenzymes, cofactors, vitamins properties of enzymes, mechanism of enzymes action, enzyme kinetics, factors affecting enzyme activity, Inhibition of enzyme action (Competitive, Non Competitive, feedback), Allosteric enzyme.

Nitrogen Metabolism:

Sources of nitrogen, Nitrogen fixation, *nif* genes in relation to symbiotic fixation in *Rhizobium*. Synthesis of amino acids and Nitrogen cycle.

UNIT II BIOENERGETICS

13 hrs

Photosynthesis – Introduction, ultra structure of the chloroplast, photosynthetic apparatus, principle of light absorption, Emerson's enhancement effect, photosystems I & II, Light reaction – Hill reaction, photophosphorylation (cyclic, non-cyclic), carbon reactions (Calvin Cycle, C4 – Pathway, CAM), Factors affecting the process.

Photorespiration– Organelles involved, mechanisms and significance.

Respiration- Introduction, mechanism of aerobic respiration – glycolysis, TCA cycle, ETS and oxidative phosphorylation, mechanism of anaerobic respiration (alcoholic fermentation and lactic acid fermentation), Respiratory Quotient and its significance, factors affecting respiration.

UNIT III PLANT GROWTH AND GROWTH REGULATORS

13hrs

Definitions of growth, Kinetics, Factors affecting growth, Phytohormones, Metabolism, Physiological effects, mode of action of auxins, gibberellins, cytokinins, ethylene and ABA. Applications of these hormones in agriculture and horticulture.

Plant movements – A brief account on the classification and types of movements.

Photobiology – A brief account of dormancy, Photoperiodism, phytochrome and its role, Florigen concept, Vernalization.

Defence mechanisms – A brief account of Secondary metabolites (Phenolics, Flavonoids and alkaloids) and their role in plant defence.

PRACTICAL PAPER – VIII PLANT PHYSIOLOGY – III **Total Units : 13**

1. Separation of Photosynthetic pigments by paper chromatography and measurement of Rf Values. **1 unit**
 2. Determination of rate of photosynthesis at different wavelengths of light. **1 unit**
 3. Determination of rate of photosynthesis at different concentrations of CO₂ **1 unit**
 4. Estimation of Ascorbic acid content in a plant sample. **1 unit**
 5. Determination of RQ of carbohydrates, fats and proteins. **1 unit**
 6. Study of geotropism, phototropism and hydrotropism. **2 unit**
 7. Evolution of O₂ during photosynthesis. **1 unit**
 8. Evolution of CO₂ during respiration. **1 unit**
 9. Kuhne's fermentation vessel. **1 unit**
 10. Moll's half leaf Experiment. **1 unit**
 11. Evolution of heat during respiration **1 unit**
 12. Determination of the rate of growth using Arc Auxanometer. **1 unit**
 13. An industrial visit to study the manufacture of alcohol / antibiotics / enzymes. **1 unit**
- Bioinformatics/ Molecular biological lab.

PRACTICAL QUESTION PAPER – VIII PLANT PHYSIOLOGY-III

Time: 3 hours

Max Marks: 35

1. Separate the photosynthetic pigments from sample **A** by paper chromatography and measure their R_f values. **8 marks**
2. Estimate the ascorbic acid content in the sample **B**. **8 marks**
3. Set up and comment on experiment **C**. **6 marks**
4. Identify and comment on physiological set up **D&E**. **2x 2 ½ = 5 marks**
5. Record and submission **5+3 = 8 marks**

SCHEME OF VALUATION

1. A. Requirement-**1** mark, principle- **2** marks, procedure and conducting the experiment- **3** marks, R_f values- **2** marks.
2. B. Requirements- **1** mark, principle- **2** marks, procedure and conducting the experiment- **3** marks, Result- **2** marks.
3. C. Identification-**1** mark, set up- **2** marks, comments-**2** marks, Labelled Diagram-**1** mark
4. D. Identification- ½ mark, comments-**1** mark, labelled diagram- **1** mark.
- E. Identification- ½ mark, comments-**1** mark, labelled diagram- **1** mark.
5. Record and Submission of field report (hand written field report only) **5+3=8** marks

LIST OF EXPERIMENTS FOR C.

- i. Evolution of O₂ during photosynthesis. ii. Evolution of CO₂ during respiration.
- iii. Moll's half leaf Experiment.
- iv. Evolution of heat during respiration (Thermos flask Experiment)

LIST OF EXPERIMENTS FOR D&E.

- i. Photosynthesis at different wavelengths of light
- ii. Photosynthesis at different concentrations of CO₂
- iii. Respirometer experiment for RQ
- iv. Kuhne's fermentation vessel v. Hydrotropism
- vi. Phototropism vii. Geotropism
- viii. Arc Auxanometer

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