

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1783

L

Unique Paper Code : 2162011201

Name of the Paper : Microbiology and Plant-Microbe Interactions

Name of the Course : B.Sc. (Hons.) Botany

Semester : II

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No- on the top immediately on receipt of this question paper.
2. Attempt FOUR questions in all including Question No. 1 which is compulsory.
3. Attempt all parts of a question together.
4. All questions carry equal marks.

1 (a) Find the **one** correct option for the following multiple-choice questions 1x5=5

(i) Which of the following is a PGPR genus?

- (A) *Bacillus*
- (B) *Plasmodium*
- (C) *Penicillium*
- (D) *Volvox*

(ii) Viral nucleic acid may consist of:

- (A) Only DNA
- (B) Only RNA
- (C) Either DNA or RNA
- (D) Both DNA and RNA simultaneously

(iii) Baltimore classification of viruses is primarily based on:

- (A) Shape of capsid
- (B) Host specificity
- (C) Type of nucleic acid and replication strategy
- (D) Presence of envelope

(iv) Teichoic acids are characteristic components of:

- (A) Gram-positive bacteria
- (B) Archaeal membranes
- (C) Gram-negative outer membrane
- (D) Mycoplasma membrane

(v) Which of the following plant bacteria lack a true cell wall?

- (A) Mycoplasma
- (B) *Streptococcus*
- (C) Phytoplasma
- (D) *Rhizobium*

(b) State **True** or **False** of the following statements:

1x5=5

- (i) During the log phase, bacteria exhibit maximum metabolic activity.
- (ii) Transformation in bacteria involves transfer of genetic material through direct contact.

- (iii) All nitrogen fixing cyanobacteria require heterocyst for nitrogen fixation.
- (iv) Photoautotrophs use organic carbon as their energy source.
- (v) Antonie van Leeuwenhoek disproved the theory of spontaneous generation.

c) Match the Following

1x5=5

Column I

- (i) Prion
- (ii) Archaea
- (iii) Spheroplast
- (iv) Viroid
- (v) Virion

Column II

- A. Creutzfeldt–Jakob disease
- B. Methanogens
- C. Penicillin-treated *E. coli*
- D. T4 bacteriophage particle
- E. Potato spindle tuber disease

2. Differentiate between the following (any three)

5x3=15

- a) Archaea and bacteria
- b) Bacterial and viral diseases in plants
- c) PGPR and mycorrhizae
- d) Prions and Viroids

3. Write short note on the following topics (any three)

5x3=15

- a) Microbial world
- b) Roles of viruses in medical sciences
- c) Discovery of viruses
- d) Fermentation

4. Draw well-labelled diagrams of the following (any three):

5x3=15

- a) Arbuscular mycorrhizae
- b) Binary fission

- c) Bacteriophage
- d) Gram-negative cell wall

5. Answer the following including suitable diagrams (**any two**):

7.5x2=15

- a) Why do rhizobia fix nitrogen inside the root but not in the soil?
- b) Why are all viruses considered as obligate intracellular parasites?
- c) Endospore formation in bacteria is not a mode of reproduction. Comment.

(2000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2049

L

Unique Paper Code : 2162011202

Name of the Paper : Plant Resources and Economic Botany

Name of the Course : **B.Sc. (Hons.) Botany**

Semester : II

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all, including Question Number 1, which is compulsory.
3. **All** questions carry equal marks.
4. **All** parts of a question must be answered together.
5. Draw labelled diagrams and write the botanical name wherever necessary.

1. Answer any **five** questions from each part. (1×5=5)

(a) Give botanical name and family (**any 5**) :

(1×5=5)

- (i) Jute
- (ii) Barley
- (iii) Pigeon pea
- (iv) Groundnut
- (v) Apple
- (vi) Radish
- (vii) Saffron

(b) Fill in the blanks (**any 5**) :

(1×5=5)

- (i) The main psychoactive compound in Opium Poppy is _____.
- (ii) _____ is the chief alkaloid of Foxglove.
- (iii) *Rauwolfia* is used for the treatment of _____.
- (iv) Example of a drug used as a myocardial stimulant.
- (v) Clove belongs to family in scientific classification is _____.

(vi) The stimulant compound present in Tea is _____.

(c) Match the following (**any 5**) : (1×5=5)

- | | |
|------------------|-------------------|
| (i) Nobilization | (a) Fibre |
| (ii) Copra | (b) Rubber |
| (iii) Digitalis | (c) Legumes |
| (iv) Hemp | (d) Sugarcane |
| (v) Tapping | (e) Drug yielding |
| (vi) Favism | (f) Coconut |

2. Write short notes on the following : (**any 3**) (3×5=15)

- (i) Economic importance of spices
- (ii) Centers of Diversity
- (iii) Fatty oils classification with example
- (iv) Classification of Fibres based upon their Origin

3. Differentiate between the following (Attempt any **three**) : (3×5=15)

(a) *Cinchona* and *Nicotiana tabacum*

- (b) Jute and Cotton fibre
 - (c) Alcoholic and Non-alcoholic beverages
 - (d) Cereals and Millets
4. Draw a well labelled diagram of followings : (any three) (3×5=15)
- (a) L.S of Clove floret
 - (b) T.S of Potato Tuber
 - (c) Morphology of Mustard plant
 - (d) L.S of Black pepper
5. Attempt any two from the following : (2×7.5=15)
- (a) Describe the morphology of the rubber plant (*Hevea brasiliensis*). Explain the process of latex tapping from para rubber tree. (3.5+4=7.5)
 - (b) Write botanical name, family, plant parts used, chemical constituents, economic importance and morphology of tea plant. (1+1+1+1+1.5+2=7.5)
 - (c) Describe the plant morphology, products and by-products of *Saccharum officinarum*. Describe methods of propagation and harvesting sugarcane crop. (2+2.5+3=7.5)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2068

L

Unique Paper Code : 2162011203

Name of the Paper : Plant Systematics

Name of the Course : B.Sc. (Hons.) Botany - DSC-6

Semester : II

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all including Question No. 1 which is compulsory.
3. Attempt **all** parts of a question together.
4. **All** questions carry equal marks.

Q1. (a) Fill in the banks (**any five**):

(5x1=5)

- (i) The taxonomic category indicated by the suffix- 'ales' is -----.
- (ii) ----- is the author of Vrikshayurveda.
- (iii) A ----- group includes a single common ancestor and all of its descendants.
- (iv) ----- is the alternative name of the family Cruciferae.
- (v) The size of the standard herbarium sheet is -----.
- (vi) 1st May, 1753 is the starting date of -----.

(b) Answer the following (**any five**):

(5x1=5)

- (i) an example of a tautonym
- (ii) the primitive living angiosperm that is considered as sister to all other extant angiosperms
- (iii) an example of a plant name with specific epithet named after a country
- (iv) type genus of family Apiaceae
- (v) a monotypic family
- (vi) author of Flora of Delhi

(c) Expand the following (**any five**):

(5x1=5)

- | | | |
|--------------|----------|---------|
| i) nom. nov. | iii) ICN | v) BSI |
| ii) IPNI | iv) OTUs | vi) APG |

P.T.O.

Q2. Differentiate between any five of the following:

(5x3=15)

- (i) Natural and artificial systems of classification
- (ii) Homonym and Synonym
- (iii) Phenogram and Cladogram
- (iv) Flora and Manual
- (v) Morphological and Biological species concept
- (vi) Autapomorphy and Synapomorphy

Q3. Write short notes on any three of the following:

(3x5=15)

- (i) Role of botanical gardens in plant taxonomy
- (ii) Co-evolution of angiosperms and animals
- (iii) Herbaceous origin of angiosperms
- (iv) Rejection of plant names
- (v) Taxonomic hierarchy

Q4.

- (a) Briefly explain the role of palynology in resolving taxonomic problems citing any three examples. (2+3)
- (b) Compare Bentham and Hooker's system of classification with Engler and Prantl's system of classification. (5)
- (c) Enumerate the principles of Numerical Taxonomy (5)

Q 5.

- (a) Briefly discuss the concept of typification. (5)
- (b) Discuss the Principle of Priority with an example. Give an account of its limitations. (2+3)
- (c) Interpret the following: (5)
 - (i) $\times$ *Polypogon monspeliensis* (1)
 - (ii) *Euonymus indicus* Heyne ex Wall. (1)
 - (iii) *Cynodon dactylon* (Linn.) Pers.
Panicum dactylon Linn. (2)
 - (iv) *Rosa webbiana* + *Rosa floribunda* (1)

(2000)

Sr. No. of Question Paper: 1804

Unique Paper Code: 2162012401
Name of the Paper: Mycology
Name of Course: B. Sc. (Hons) Botany
Semester: IV

L

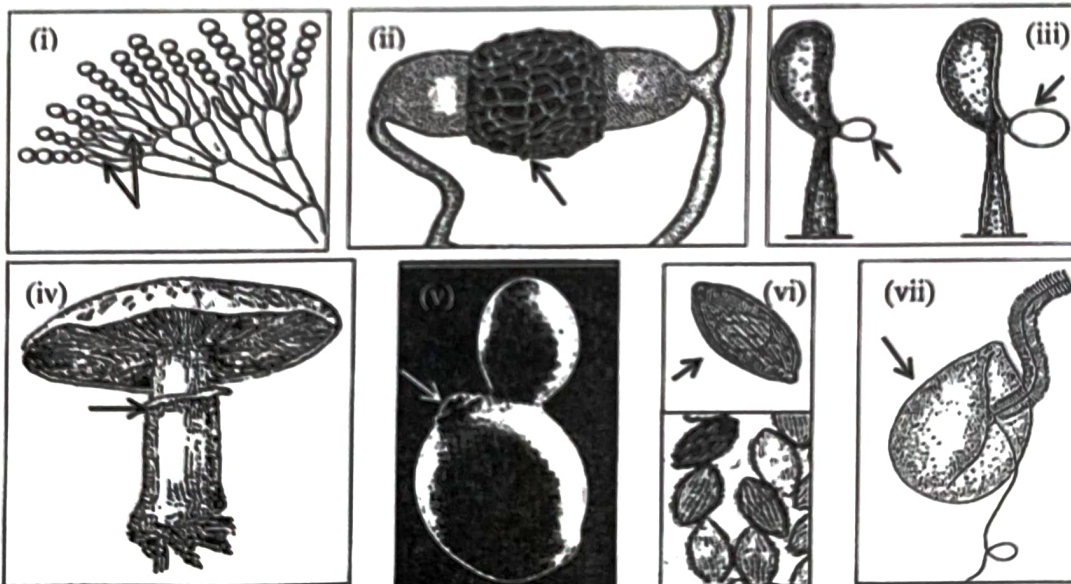
Duration: 2 Hours

Maximum Marks: 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all.
3. **Question number 1 is compulsory.** All questions carry equal marks.
4. All parts of a question must be answered together.
5. **Draw diagrams wherever required.**

1. (a) Identify the structure (pointed by arrow) visible in the following diagrams/pictures and name a studied genus in which it occurs (Attempt any five). (1x5=5)



- (b) Distinguish the following terms in one or two sentences (Attempt any five). (1x5=5)

- (i) Hypha and Pseudohypha
- (ii) Hypertrophy and Hyperplasia
- (iii) Heteroecious fungi and Autoecious fungi
- (iv) Plasmodium and Pseudoplasmodium
- (v) Sporangium and Sporangium
- (vi) Fungi and Allied fungi
- (vii) Dolipore and Simple pore
- (viii) Perithecium and Pseudothecium

(c) Match the following:

(1x5= 5)

- | | |
|------------------------------|---------------------------------|
| (i) Litmus paper | (A) <i>Fusarium graminearum</i> |
| (ii) Woronin bodies | (B) Mycorrhiza |
| (iii) Zearalenone | (C) Ascomycetes |
| (iv) A B Frank | (D) Chytridiomycota |
| (v) Straminipilous flagellum | (E) Oomycota |
| | (F) <i>Rocella tinctoria</i> |

2. Differentiate between the following (Attempt any three):

(5x3=15)

- (i) Ascomycetes and Basidiomycetes
- (ii) Primary and secondary mycelium
- (iii) Cleistothecium and Apothecium
- (iv) Primary zoospore and secondary zoospore
- (v) Aeciospore and Teliospore
- (vi) Foliose and Fruticose lichen

3. Write short notes on the following (Attempt any three):

(5x3=15)

- (i) Types of spores in *Puccinia*
- (ii) Thallus organization in fungi
- (iii) Fairy ring in mushrooms
- (iv) Salient features of slime moulds
- (v) Fungal biopesticides and their advantages over chemical pesticides

4. Draw the well-labelled diagram of the following (Attempt any three):

(5x3=15)

- (i) *Neurospora*: V. S. Perithecium
- (ii) Dolipore septum: Structure
- (iii) *Puccinia graminis tritici*: V. S. Aecidium
- (iv) *Rhizopus*: W. M. Asexual stage
- (v) T.S. Root showing Vesicular Arbuscular Mycorrhizal (VAM) fungi

5. Attempt (any two) from the following:

(7.5x2= 15)

- (i) Name the causal organism of black wart disease and its host. Illustrate its life cycle and describe its stages in detail. (2+5.5=7.5)

- (ii) Why is *Neurospora* called "red bread mould"? Name the pigment responsible and its location. Describe the asexual stage of *Neurospora* with the help of suitable diagrams, and add a note on its importance. (0.5+1+4+2=7.5)

- (iii) "Preparation of beverages cannot be imagined without fungi." Justify the statement. Describe the production of alcoholic and non-alcoholic beverages using different fungi and their raw materials as examples. (2.5+5=7.5)

(1500)

[This question paper contains 2 printed pages.]

Your Roll No _____

Sr. No. of Question Paper : **1724**
Unique Paper Code : 2162013601
Name of the Paper : Plant Biotechnology
Name of Course : BSc (H) Botany
Semester : VI

Duration: 2 Hours

Maximum Marks: 60

Instructions for the Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all.
3. **Question No. 1 is compulsory.**
4. Attempt all parts of a question together.

1. Answer the following questions

(a) Define the following (**any 5**)

(1x5=5)

- (i) Bioluminescence
- (ii) Nuclease
- (iii) Electrophoresis
- (iv) Competent cells
- (v) Protoplast
- (vi) Cosmid

(b) Give contributions of (any 5) (1x5=5)

- (i) W. Arber, H.O. Smith and D. Nathans
- (ii) S. Guha and S.C. Maheshwari
- (iii) R. A. Jefferson
- (iv) E. Neumann
- (v) Ingo Potrykus and Peter Beyer
- (vi) Ananda M Chakrabarty

(c) Expand the following (any 5) (1x5=5)

- (i) PEG
- (ii) BAC
- (iii) pUC
- (iv) MS medium
- (v) MCS
- (vi) Ti plasmid

2. Write short notes (any 3) (5x3=15)

- (a) Flavr Savr tomato
- (b) Green Fluorescent Protein
- (c) Micropropagation
- (d) Binary vector system

3. Differentiate between the following (any 3) (5x3=15)

- (a) Haploid and Triploid plantlets
- (b) Cybrids and Somatic hybrids
- (c) Prokaryotic cloning vectors and eukaryotic cloning vectors
- (d) Direct and indirect gene transfer

4. (a) Why are Restriction Enzymes known as molecular scissors? Explain the four main types of Restriction Enzymes. (10)

(b) Discuss biosafety issues of growing transgenic plants. (5)

5. (a) Explain the process of haploid production through androgenesis. Write the applications of haploid production in crop improvement. (9)

(b) Describe principle of GUS assay and its applications in plant molecular biology. (6)

(1500)

6

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1762

L

Unique Paper Code : 2162013603

Name of the Paper : Advanced Tools and Analytical
Techniques in Plant Biology

Name of the Course : **B.Sc. (Hons) Botany**

Semester : VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question number 1 is compulsory.
3. Attempt **FOUR** questions in total.
4. **All** questions carry equal marks.
5. **All** parts of a question must be answered together.
6. Draw graphics wherever required.

1. (a) Define (**any five**) : (5marks)

- (i) Fluorescence
- (ii) Chromosome painting
- (iii) Radioisotopes
- (iv) Immobilization
- (v) Western blotting
- (vi) Marker enzyme

(b) Write the role of (**any five**) : (5marks)

- (i) ddNTPs
- (ii) Nitrocellulose membrane
- (iii) Salt concentration in DNA hybridization
- (iv) Electron gun
- (v) Glutaraldehyde
- (vi) Taq polymerase

(c) True or false (**any five**) : (5marks)

- (i) Cryofixation of materials includes use of liquid nitrogen.
- (ii) Separation of molecules in paper chromatography is based on solid-liquid partitioning.

(iii) In isopycnic centrifugation the maximum density in the gradient exceeds the density, of the particles to be separated.

(iv) RFLP is a codominant marker.

(v) Co-59 is a radioactive isotope used in nuclear reactors.

(vi) Gamma rays have highest penetration ability.

2. Discuss the following (**any three**) : (3×5=15)

(a) Carbohydrates and lipids cannot be separated by electrophoresis.

(b) How and why temperature, pH and osmotic potential are regulated during tissue homogenization?

(c) What are the advantages of HPLC over normal column chromatography.

(d) FISH Technique and its applications.

3. Write short notes on (**any three**) : (3×5=15)

(a) What is the principle and applications of IR spectrophotometry.

- (b) What is negative staining? Give an example.
 - (c) Density gradient Centrifugation.
 - (d) Pulse Chase experiment.
4. (a) Explain the sample preparation and working of SEM and TEM. (8)
- (b) Explain Ultracentrifugation and types of rotors used in centrifugation. (7)
5. (a) What is DNA polymorphism? Explain the techniques and applications of RFLP and SSR. (8)
- (b) Explain about uses of radioisotopes in biological research and biosafety measures taken for disposal of radioactive materials. (7)
6. (a) Describe the basics of designing a primer in PCR and explain the components along with procedure involved in the technique. (8)
- (b) Explain principle and functioning of Native PAGE and SDS-PAGE. (7)

7

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2030 L

Unique Paper Code : 2162012403

**Name of the Paper : Developmental Biology of
Angiosperms: Form, Anatomy
and Function**

Name of the Course : B.Sc. (Hons) Botany

Semester : VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory. Attempt **Four** questions in all. **All** questions carry equal marks.
3. **All** parts of questions must be attempted together.
4. Draw well labelled diagrams wherever necessary.

1. (a) Fill in the blanks (any five) : (1×5=5)

(i) The rod-like sclereids are called as _____ .

(ii) Epidermis in xerophytic plants is often covered by a waxy layer known as _____ .

(iii) In _____ vascular-bundles, the xylem is surrounded by two strands of phloem.

(iv) Tunica-corpus theory was given by _____ .

(v) _____ are large thin-walled epidermal cells in grass leaves that help in folding and unfolding during water stress.

(vi) _____ present in endodermis blocks the apoplastic transport in the root.

(vii) Non-Protoplasmic materials found in cells are _____ .

(b) Give one word for the following (**any five**) :

(1×5=5)

(i) Parenchyma cells are designed for high-volume nutrient transfer with unique cell-wall ingrowth labyrinths present in minor veins of the leaf.

(ii) A hemispherical region of inactive cells located between the root cap and the active meristematic region in a plant's roots.

P.T.O.

- (iii) The outermost, dead layer of bark on trees and woody plants, comprising accumulated periderm, cortex, and phloem tissues.
- (iv) Wood formed in trees in response to gravitational stimuli that cause stems or branches to bend or lean.
- (v) Specialised pores on leaf margins or tips that secrete water in liquid form through a process called guttation.
- (vi) The process of maturation of unspecialized cells from meristems into specialised types (e.g., xylem, phloem, epidermal cells) to perform specific functions.

(c) Define the following terms (**any five**) :

(1×5=5)

(i) Aerenchyma

(ii) Calyptrogen

(iii) Open vascular bundle

(iv) Plasmodesmata

(v) Cuticularization

(vi) Amphistomatic leaf

2. Differentiate between (**any three**) :

(3×5=15)

(a) Sclerenchyma and Collenchyma

(b) Monocot root and Dicot root

(c) Inner bark and outer bark

P.T.O.

(d) Ring porous wood and diffuse porous wood

(e) Adcrustation and Incrustation

3. Draw a well labelled diagram of **(any three)** :

(3×5=15)

(a) Vertical section of a leaf showing Kranz anatomy

(b) Transverse section of a stem showing phloem
wedges

(c) Longitudinal section of root apex

(d) Transverse section of Dicot root

4. Write short notes on **(any three)** : (3×5=15)

(a) Ergastic substances

(b) Applications of anatomy in Forensics

- (c) Laticifers
 - (d) Shoot Chimeras
 - (e) Seasonal activity of vascular cambium
5. (a) Write a note on types of trichomes with suitable examples and diagrams. (5)
- (b) Explain the structure and functions of the lateral meristem in plants. Elucidate how it contributes to secondary growth in a dicot stem with suitable diagrams. (10)
6. (a) Critically compare the Apical Cell Theory, Histogen Theory, and Tunica Corpus Theory. Highlight their limitations in explaining shoot apex organisation in angiosperms. (10)

P.T.O.

- (b) Explain anatomical adaptation in Nerium leaf with
a labelled diagram. (5)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7232

L

Unique Paper Code : 2163010021

Name of the Paper : Advances in Genetics, Genomics and Plant Breeding

Name of the Course : B.Sc. (Hons.) Botany

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question 1 is compulsory.
3. Only **four** questions are required to be attempted in all.
4. Attempt all parts of every question together.

Q.1. (a) Define the following (*any five*):

(1X5=5)

- i. Haplotype
- ii. Ideogram
- iii. Apomixis
- iv. Cistron
- v. Metagenome
- vi. Molecular marker
- vii. Mutagenesis

(b) Expand (*any five*):

(1X5=5)

- i. GISH
- ii. SNP
- iii. ChIP
- iv. CRISPR
- v. QTL
- vi. GWAS
- vii. ELSI

(c) Fill in the blanks (*any five*): (1X5=5)

- (i) DNA methylation commonly occurs at _____ bases.
- (ii) CRISPR-Cas9 is a _____ editing tool.
- (iii) Metagenomics helps in studying _____ communities.

P.T.O.

- (iv) Male sterility is useful in _____ production.
- (v) The basic unit of chromatin is _____
- (vi) Complementation test distinguishes between _____ and _____ mutations.
- (vii) Drought resistance is an example of _____ stress.

Q2. Differentiate between the following (*any three*):

(5×3=15)

- (i) Primary and Secondary gene pool
- (ii) Heterochromatin and Euchromatin
- (iii) Conventional breeding and MAS
- (iv) Addition line and Nullisomic line
- (v) Bisulfite sequencing and ChIP-Seq

Q3. Write short notes on the following (*any three*):

(5×3=15)

- (i) CRISPR-Cas9
- (ii) Clonal Selection
- (iii) Metagenomics
- (iv) Bulk Segregation Analysis
- (v) Mating Systems in plant

Q4. (a) Briefly explain molecular cytogenetic techniques (FISH, GISH, Fibre-FISH) and their applications in gene mapping and introgression studies. (8)

(b) Describe chromatin organization and DNA packaging in eukaryotes. (7)

Q5. (a) Discuss epigenetic mechanisms (DNA methylation, histone modification, chromatin remodelling) and their role in gene regulation in plants. (8)

(b) Describe different types of chromosomal aberrations and discuss their evolutionary significance in plants. (7)

Q6. (a) Discuss the strategies used in mapping different agronomic traits in any one of the crops - tomato, cotton, rice, wheat. (supplement answer with flow charts). (10)

(b) Discuss in brief the regulatory framework for genome editing in agriculture and medicine citing suitable examples. (5)

(400)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1831

L

Unique Paper Code : 2163012003

Name of the Paper : Applied Phycology

Name of the Course : Botany (DSE)

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All questions are compulsory.
3. Attempt all parts of a question together.

1. (A) Expand the following (any 10)

10X1=10

- a) BBM Medium
- b) BOD
- c) DDT
- d) DHA
- e) EDTA
- f) EPA
- g) HAB
- h) HRAP
- i) PAH
- j) PAR
- k) PBRs
- l) PES Medium
- m) PUFA
- n) ROS

(B) Give ONE alga (Generic name) associated with (any five):

5x1=5

- a) Alginate
- b) Astaxanthin
- c) beta-carotene
- d) Bioluminescence
- e) Carrageenan
- f) Pollution Indicator
- g) Space food
- h) Heterocysts

2. Draw a well labelled diagram of the following (any Three)

3X5=15

- a) Draw a well-labelled diagram displaying the structural morphology of *Acetabularia*.

- b) Provide a detailed, labelled diagram illustrating the structure of a cyanobacterial heterocyst.
- c) Draw a schematic diagram of a closed photobioreactor, ensuring all primary components are clearly labelled and explained.
- d) Provide a well-labelled diagram of a phycoremediation system utilised for wastewater treatment using algae.
- e) Draw a sequential schematic diagram demonstrating the process of biodiesel production from microalgae.
- f) Illustrate the complex life cycle of *Porphyra* using a comprehensive, well-labelled diagram

3. Briefly explain (any three)

3X5=15

- a) Write a short note on the development and environmental potential of algal bioplastics.
- b) Explain the causes of red tides and discuss the impact of three major algal toxins (phycotoxins).
- c) Describe the preparation and agricultural benefits of seaweed liquid extracts (SLE) as biofertilisers.
- d) Explain why *Ectocarpus* is considered an ideal model organism for genetic and developmental studies in brown algae.
- e) 'algae are the ideal superfoods of the future'. Support this statement by detailing the nutritional benefits of at least five distinct examples from various algal groups.

4. Answer any two of the following

2X7.5=15

- a). Distinguish between the first, second, and third generations of biofuels. Discuss how algal biofuels address the limitations of earlier generations, and outline the current commercial challenges facing the algal biofuel industry.
- b) Write an account of the various applications of algal phycocolloids.
- c) Outline the economic and environmental benefits of seaweed farming. Explain two standard methods of commercial seaweed cultivation and discuss the primary challenges currently faced by the mariculture industry.
- d) Briefly discuss the formation of diatomaceous earth and explain its various commercial and industrial applications.

Sr. No. of Question Paper: 1923

Unique Paper Code: 2162012402
Name of the Paper: Ecology and Conservation
Name of Course: Botany
Semester: IV

Duration: 2 Hours

Maximum Marks: 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt four questions in all.
3. **Question No. 1 is compulsory.**
4. All parts of a question should be answered together.

1. (a) Match the following 1 x 5 = 5

- | | | | |
|-----|---------------------------|----|--|
| i | Luxmeter | a) | Total water in soil |
| ii | <i>Nepenthes khasiana</i> | b) | Uppermost warmer layer of water body |
| iii | Holard | c) | Predation |
| iv | Food web | d) | Instrument used to measure light intensity |
| v | Epilimnion | e) | Interlocked food chain |

(b) Define the following (Any five) terms 1 x 5 = 5

- i Edge effect
- ii Sciophytes
- iii Alluvial soil
- iv Pedon
- v Hydrosere
- vi Parasitism
- vii Capillary water

(c) Give one word (Any five) for the following 1 x 5 = 5

- i. The ability of organisms for self-regulation, which enables them towards to changing environment.
- ii. The functional level of an organism in any food chain.
- iii. Process of successful establishment of species in a new area.
- iv. Small organism which feeds on the dead bodies of other organisms.
- v. Fully decomposed organic matter in soil.
- vi. Zone of transition between different types of communities.
- vii. A recently evolved spp. restricted to a particular geographic region.

2. Differentiate between (Any three) 5 x 3 = 15

- (a) Mor and mull humus
- (b) k and r selection
- (c) Paleoendemics and neoendemics
- (d) Gaseous and sedimentary cycle
- (e) Analytical characters and synthetic characters

3. Write short notes on (Any three)

5 x 3 = 15

- (a) Metapopulation
- (b) Shelford's law of Tolerance
- (c) Ecological pyramids
- (d) Different types of water in soil
- (e) Light as an ecological factor

4. (a) What is ecological succession? Explain xerosere with the help of suitable diagrams. 7

(b) What is energy flow in an ecosystem? Explain the Y-shaped energy flow model and discuss the main features of this model. 8

5. (a) What are the different strategies for conservation.? Explain On-farm conservation strategies with example. 7

(b) What are biotic interactions? Discuss various types of biotic interactions. 8

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 259

L

Unique Paper Code : 2163010009

Name of the Paper : RESEARCH METHODOLOGY

Name of the Course : Botany

Semester : VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question number 1 is compulsory.
3. Attempt **FOUR** questions in total.
4. **All** questions carry equal marks.
5. **All** parts of a question must be answered together.
6. Draw graphics wherever required.

1. (a) Give one word for (**any five**)

(1x5=5 Marks)

- i. A list of questions, along with the choice of answers, printed or typed in a sequence on a form used for acquiring specific information from the respondents.
- ii. Scale of measurement when the data is grouped into categories with no order or ranking.
- iii. Statistical method used to determine the relationship between independent variable (X) and the dependent variable (Y).
- iv. The unethical practice of presenting someone else's work as one's own.
- v. A specific condition applied to experimental units (participants, subjects, or plots) to measure its effect on a dependent variable.
- vi. A structured blueprint for collecting, measuring, and analyzing data to answer a specific research problem.

(b) Match the following:

(1x5=5 Marks)

i. A free database for biomedical and life sciences literature	a. Heat map
ii. Graphical representation showing percentage	b. Mendeley
iii. Plagiarism detection software	c. Pie chart
iv. Graphical representation of data where values are represented using colors	d. Turnitin
v. A reference management software	e. Pubmed

(c) Define (**any five**)

(1x5=5 Marks)

- i. Hypothesis
- ii. Royalty

P.T.O.

- iii. Empirical Research
- iv. Control
- v. Citation
- vi. Impact Factor

2. Differentiate between (**any three**)

(5x3=15 Marks)

- i. Primary data and Secondary data
- ii. Research paper and Review paper
- iii. Qualitative and Quantitative research
- iv. Patents and Copyright

3. Write short notes on (**any three**)

(5x3=15 Marks)

- i. Data quality
- ii. Experimental Designs
- iii. Acknowledgements in technical research writing
- iv. Ethics in Research

4. (a) Describe different methods of data collection with suitable examples. (7 Marks)

(b) What are citation management tools? Name any two such tools and explain any one in detail. (8 Marks)

5. (a) What are literature sources? Discuss primary, secondary and tertiary sources of literature information with examples. (7 Marks)

(b) Define search engines. Explain the working and applications of at least three search engines. (8 marks)

6. A researcher has tested the effect of microbial inoculants on heavy metal contamination of soil. The percentage reduction in the levels of heavy metal in the soil after microbial inoculation was observed as follows:

S. No.	Heavy metal reduction (%)	Microbial Inoculant (mL/pot)
1	20	28
2	40	42
3	60	57
4	80	69
5	100	81

a) Draw a scatter plot taking microbial inoculant as the independent variable (X-axis) and heavy metal reduction as the dependent variable (Y-axis). (5 Marks)

b) Calculate the Pearson's correlation coefficient (r) and interpret the result. (10 Marks)

(2000)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1743

L

Unique Paper Code : 2162013602

Name of the Paper : PLANT BIOCHEMISTRY AND METABOLISM

Name of the Course : BOTANY

Semester : VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt four questions in all . **Question no. 1 is compulsory.**
3. All parts of question should be answered together.

Q1. (a) Fill in the blanks

(1x5 = 5 marks)

- i) The synthesis of complex molecules from simple molecules with the utilization of energy is called
- ii) In photosynthesis Light reaction occurs in and the dark reaction occurs in
- iii) For the production of one molecule of GlucoseATP & NADPH₂ molecules go through the C₃ cycle.
- iv) number of molecules of Acetyl Co-A are produced after beta-oxidation of 16 carbon fatty acid.
- v) The term enzyme was first named by

(b) Expand the following

(1x5 = 5 marks)

- i. RuBisCO
- ii. PEP
- iii. TAG
- iv. FAD
- v. DCPIP

(C) Define the following (Any five)

(1x5 = 5 marks)

- i. Amphibolic pathway
- ii. Coupled Reaction
- iii. Absorption Spectrum
- iv. Michaelis constant (K_m)
- v. RQ
- vi. Phosphorescence
- vii. Plastoquinone (PQ)

P.T.O.

Q2. Differentiate between the following (*Any Five*)

(5x3 = 15 marks)

- i) C3 and C4
- ii) Cyclic and Non- Cyclic Photophosphorylation
- iii) Lock-key and Induced fit hypothesis of enzyme action
- iv) Substrate level phosphorylation and oxidative phosphorylation
- v) Competitive and non-competitive inhibition
- vi) Saturated and unsaturated fatty acids

Q3. Write short notes of the following (*Any three*)

(3x5=15 marks)

- i) Ammonia assimilation in nodules
- ii) Cyanide resistant respiration
- iii) Classification of enzymes
- iv) Blackmans law of limiting factor
- v) Mobilization of lipids during seed germination

Q4. (a) Explain various factors affecting enzyme activity

(7 marks)

(b) Give an account of Beta oxidation of fatty acids along with its energetics (8 marks)

Q5 (a) Discuss in detail C₂ cycle and its significance.

(6+2=8 marks)

(b) Explain the flow of electrons in light dependent phase with the help of a diagram.

(5+2=7marks)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 106

L

Unique Paper Code : 2162014801

Name of the Paper : INTEGRATIVE PLANT BIOLOGY

Name of the Course : Botany (DSC)

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All the questions are compulsory
3. Attempt all parts of a question together
4. Draw well-labeled diagrams wherever necessary.

1. (A) Fill in the blanks (any five)

5X1=5 marks

- a) Most plants use anthocyanins (purple pigments) for UV protection. *Marchantia* lacks these and uses a unique, ancient class of pigments called
- b) *Prosopis* spp. shading saguaro seedlings show type interaction.
- c) is the first plant and the third eukaryote to have its genome fully sequenced, providing a reference point for all plant biology.
- d) According to theory "The evolution of the embryo was likely an adaptation to land where water is scarce".
- e) and are two major cereal crops where detailed genetic evidence of inflorescence branching has been studied.
- f) In July 2021, the became the first country to approve the commercial cultivation of Golden Rice.
- g) is the integrated analysis of multiple biological data layers (such as genome, transcriptome, proteome, and metabolome) to understand how a biological system functions as a whole.

(B) Match the following (any five)

5X1=5 marks

Column A	Column B
a) Rhynie chert	i. <i>Neurospora crassa</i>
b) ~17 missing cpDNA genes	ii. <i>Equisetum</i>
c) one gene-one enzyme	iii. direct auxin flow
d) Sphenopsida	iv. Attenuators
e) PIN transporters protein	v. Adaxial-abaxial polarity
f) class III HDZIPs	vi. <i>Gnetum</i>
g) Cis-acting RNAs	vii. <i>Lithospermum erythrorhizon</i>
h) Shikoinin	viii. Devonian site with diverse fossilized stomata

P.T.O.

(C) Expand the following (any five)

5X1=5 marks

- a) CCM
- b) CRISPR
- c) LHC
- d) ABA
- e) SAM
- f) rbcL
- g) STRING
- h) RdDM

2. Differentiate between the following (any three)

3X5=15 marks

- a) Commensalism, Mutualism and Parasitism in Sonoran Desert
- b) Cyclic, Pseudo-Cyclic and Chloroplast-to-Mitochondrion Electron Flow
- c) *Tillandsia fasciculata* (Grey, CAM) *Tillandsia leiboldiana* (Green, C3)
- d) cpDNA and mtDNA
- e) Traditional biology and System biology
- f) miRNA and siRNA

3. Write short notes on the following (any three)

3X5=15 marks

- a) Feminizer gene and sex chromosomes of *Marchantia*
- b) Cutin and Cuticular waxes
- c) Lysigenous aerenchyma
- d) Nanoparticle uptake, translocation, and biological impact in plants
- e) Five commonly cultivated seaweeds and their uses.
- f) snRNA

4. Answer any two of the following

2X7.5=15 marks

- a) Why is *Cuscuta* referred to as the "Merchant of Proteins"?
- b) Although photosynthesis is a complex process and a major area of research, many aspects remain unresolved. Briefly explain any five such questions.
- c) Major applications of AI and machine learning in Plant Science.
- d) RNA is involved in much more than just transcription. Explain this statement with appropriate examples.

(14)
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7231

L

Unique Paper Code : 2163010020

Name of the Paper : Immunological Concepts and
Applications in Plant Science

Name of the Course : **Botany**

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Each question carries 15 marks, so attempt **FOUR** questions in all.
3. Question No. 1 is compulsory.

1. (a) Define the following (**Any five**) (5×1=5)

- (i) Valence
- (ii) Elicitors
- (iii) PR genes
- (iv) Cuticle

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(v) Biotrophs

(vi) Calcium signatures

(b) Expand the following (Any five) (5×1=5)

(i) MYB

(ii) CBLs

(iii) CTR1

(iv) PAMPs

(v) JAR

(vi) *Flg22*

(c) Fill in the blanks (any five) (5×1=5)

(i) The _____ model predicts resistance when R gene matches an Avr gene.

(ii) _____ type of fungus, first kills the host and then feeds upon it.

(iii) _____ is also known chemically as N-(17-hydroxylinolenoyl)-L-glutamine, that induces volatile secondary metabolites in maize plants.

(iv) WRKY transcription factors binds specifically to the _____ element present in promoters of pathogen-responsive genes.

(v) _____ an 18 amino acid fragment of the bacterial elongation factor Tu.

(vi) _____ are filled with a nasty cocktail of histamine, oxalic acid, tartaric acid, formic acid, and serotonin.

Differentiate between **any three** : (3×5=15)

- (i) SAR and ISR
- (ii) Cyst nematodes and Root Knot Nematodes
- (iii) Compatible and incompatible plant parasite interactions
- (iv) Plant and Animal Immune Systems

Write short notes on **any five** of the following :

(5×3=15)

- (i) Structure of antibody
- (ii) Role of respiratory burst oxidase homolog protein
- (iii) SiRNA as a tool for imparting disease resistance in plants.
- (iv) Gene-for-gene hypothesis: a Flor's Model
- (v) Pre-existing biochemical defences
- (vi) Mechanical barriers constitute the first line of defence

- (vii) Biopesticide agents based in ISR
4. (a) CTR1 acts as a negative regulator of the ethylene response pathway. Justify this statement by describing the pathway in detail. (8)
- (b) How can CRISPR-Cas9-based genetic engineering be used for crop improvement? Discuss with a suitable example. (7)
5. (a) Explain the types of effector molecules and how they facilitate the colonization of plant host cells. (7)
- (b) Discuss the role of any two different transcription factor families of your choice in mediating plant defense response. (8)
- 6 (a) Explain flagellin-induced resistance as a representative model of pattern-triggered immunity in plants. (7)
- (b) Describe the major signaling pathway in plant defense against insect herbivores and explain how signals reach distal tissues to prepare for impending herbivory, with one example. (8)

[This question paper contain printed pages]

Your roll No.....

Serial No. : 7233

Unique Paper Code : 2163010022

Name of the Paper : PLANT GENOMICS, PROTEOMICS AND BIOINFORMATICS

Name of the Course : Botany

Semester : VIII

Duration: 2 Hours

Maximum Marks: 60

Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
- Question No.1 is compulsory.**
- Attempt any **FOUR** questions in all.
- All parts of the question must be answered together.
- Draw diagrams wherever required.

Q. 1 (a) Define the following (**any five**):

(1x5 = 5)

- Orthologous sequences
- Conserved domain
- Database
- Primer
- e-value
- Guide RNA (gRNA)

(b) Match the following:

(1x5 = 5)

- | | |
|---------------------|------------------------------------|
| (i) MALDI-ToF | (a) Example of nucleotide database |
| (ii) GenBank | (b) Search engine |
| (iii) Entrez | (c) Introns and repetitive DNA |
| (iv) Non-coding DNA | (d) Mass spectrometry technique |

(v) Histone acetylation

(e) Activation of gene expression

(c) Expand the following (**any five**):

(1x5 = 5)

- (i) DDBJ
- (ii) KEGG
- (iii) PDB
- (iv) NCBI
- (v) HMP
- (vi) SDS-PAGE

Q. 2 Write short notes on **any three** of the following:

(5x 3 = 15)

- (a) Illumina sequencing
- (b) Genomics ethics
- (c) X-ray crystallography
- (d) BLAST

Q. 3 Differentiate between (**any three**):

(3x 5 = 15)

- (a) Primary and secondary structure of protein
- (b) Eukaryotic and prokaryotic genome
- (c) Genetics and epigenetics
- (d) Local and global sequence alignment

Q. 4. (a) Define bioinformatics. Elaborate on its scope and significance in modern biological research, with specific reference to its applications in genomics and proteomics. (8 marks)

(b) Define molecular phylogeny. Discuss its fundamental principles, commonly used methods, and applications in understanding evolutionary relationships. (7 marks)

Q. 5 (a) What is the CRISPR-Cas9 system? Describe its stepwise mechanism in genome editing, supported with suitable diagrams. (8 marks)

(b) Define *metagenomics*. Discuss its applications in the biodegradation of environmental pollutants and the restoration of ecosystems. (7 marks)

(16/)
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7234

L

Unique Paper Code : 2163010024

Name of the Paper : Plant Stress Biology

Name of the Course : Botany

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all.
3. Question No. 1 is compulsory.
4. **All** questions carry equal marks.
5. Draw well-labelled diagram wherever necessary.

1. (a) Expand the following (**any five**) : (5×1=5)

- (i) LEA
- (ii) MAPK
- (iii) AQPs
- (iv) SA

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(v) SOD

(vi) HSPs

(b) Match the following : (5×1=5)

- | | |
|----------------------|--|
| (i) HSP70 | a) Detoxification of H_2O_2 |
| (ii) Catalase | b) Wound and herbivory signalling |
| (iii) Calmodulin | c) Quaternary ammonium osmoprotectant |
| (iv) Glycine betaine | d) Calcium Sensor |
| (v) Jasmonic acid | e) Chaperone induced by temperature stress |

(c) Fill in the blanks (**any five**) : (5×1=5)

- (i) One of the mechanisms to evade drought stress in plants is to produce more _____ which helps in stabilizing the membranes and enzymes.
- (ii) *Atriplex nummularia* is an example of _____ .
- (iii) _____ of a plant is the heat-killing temperature depending upon the time of exposure.

- (iv) The antioxidant enzyme that converts hydrogen peroxide to water and oxygen in peroxisomes is _____.
- (v) _____, the most ubiquitous second messenger is involved in drought and salt stress signalling pathway.
- (vi) Transgenic alfalfa (*Medicago* sp.) overexpressing tobacco Mn SOD shows enhanced tolerance to _____ stress.

2. Differentiate between **(any three)**: - (3×5=15)

- (i) Acclimation vs Adaptation
- (ii) Salt exclusion vs Salt tolerance
- (iii) Alkaloids and Phenolics
- (iv) Biotrophs vs Necrotrophs

3. Write notes on the following **(any three)**: (3×5=15)

- (i) Late embryogenesis abundant proteins
- (ii) Hypersensitive response
- (iii) Mechanism of Salicylic acid signalling during plant stress

(iv) Traditional and modern methods of crop improvement

4. (a) Discuss the osmotic and cytotoxic effects of salinity stress in plants. (8)
- (b) Discuss the role of nitric oxide (NO) in stress sensing and signalling mechanisms in plants. (7)
5. (a) Describe the zig-zag model in plant defense with the help of suitable diagrams. (8)
- (b) Explain temperature stress in plants. Discuss the role of heat shock proteins in stress tolerance mechanisms. (7)
6. (a) What is osmotic stress? Elaborate on the mechanism of various ion transporters during salinity stress in plants. (8)
- (b) Give a brief account of stress-tolerant genetically engineered plants. (7)

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[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7908

L

Unique Paper Code : 2163010020

Name of the Paper : Immunological Concepts and Applications in Plant Science

Name of the Course : Botany

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No- on the top immediately on receipt of this question paper.
2. Each question carries 15 marks, so attempt FOUR questions in all.
3. Question No. 1 is compulsory.

1. (A) Define **any five** of the following terms:

(5 x 1 = 5)

- i. Hapten
- ii. R gene
- iii. Immunoglobulin
- iv. Epitope
- v. Valence
- vi. Necrotroph

(B) Fill in the blanks **any five** of the following:

(5 x 1 = 5)

- i. In the plant immune system, the first layer of induced immunity triggered by recognition of PAMPs is called _____
- ii. According to Flor's model, for each resistance gene in the host, there is a corresponding _____ gene in the pathogen.
- iii. _____ are small nucleic acid molecules that play a key role in developing antiviral resistance in plants.
- iv. _____ are PRRs that detect flagellin in bacteria and trigger PTI in plants.
- v. The _____ are proteins that bind to specific DNA sequences to activate or repress defence genes.
- vi. _____ is a whole plant immunity that develops after a localised infection.

(C) Expand **any five** of the following:

(5 x 1 = 5)

- i. CaM
- ii. CBL
- iii. HR
- iv. NLRs
- v. AREB
- vi. Avr

2. Write Short Notes on **any three** of the following:

(3 x 5 = 15)

- i. Management of plant pathogens in agriculture.
- ii. Flor's model of plant pathogen interaction.
- iii. Biochemical defenses in plants
- iv. SiRNA and disease resistance in plants
- v. Differentiate between PTI and ETI

3. Draw well labelled diagrams representing **any three** of the following:

(3 x 5 = 15)

- i. Flagellin-induced resistance as a model system of PTI
- ii. Structure of Antibody
- iii. Different signaling routes for ROS burst including activity of the NADPH oxidase.
- iv. MAPK cascade in plant defense
- v. Zig-zag model

4. A. Discuss the different pre-existing mechanical defense mechanisms present in plants.

B. Describe the defense response elicited upon Calcium spiking in plant cells. (7.5 + 7.5)

5. A. Elaborate the Salicylic acid, Jasmonic acid, and Ethylene mediated signaling cascades in response to pathogen attack in plants. (10)

B. Discuss the application of CRISPR Cas technology for crop improvement. (5)

6. A. Describe the role of any two transcription factor families in mediating plant defense response. (10)

B. ISR is considered a valuable tool for sustainable agriculture. Justify this statement by providing suitable reasons.

OR

Describe the mechanism of SAR with reference to the key molecules involved in the process. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7911

L

Unique Paper Code : 2163010024

Name of the Paper : PLANT STRESS BIOLOGY

Name of the Course : **Botany**

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No- on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all. All questions carry equal marks.
3. All parts of questions must be attempted together.
4. Question No. 1 is compulsory.
5. Draw well labelled diagrams wherever necessary.

Q1. (a) Fill in the blanks (**any five**):

5 x 1 = 5 marks

- i. Soil containing high Na_2CO_3 and high sodium absorption ratio due to low $[\text{Mg}^{2+}]$ and $[\text{Ca}^{2+}]$ known as
- ii. The process by which plants accumulate low-molecular-weight organic compounds to maintain osmotic balance under stress is called
- iii. _____ is a compatible solute synthesized from glutamate and is particularly accumulated under drought and salinity stress.

- iv. Under drought stress, stomatal closure is primarily mediated by the phytohormone _____.
- v. _____ are low-molecular-weight proteins induced by pathogen attack that include chitinases, glucanases, and thaumatin-like proteins.
- vi. The protection of a host against a wide range of pathogens is known as the _____ resistance.

(b) Expand the following (**any five**):

5 x 1 = 5 marks

- i. POD
- ii. PUFA
- iii. SOS
- iv. HR
- v. PR proteins
- vi. CDPK

(c) Define the following (**any five**):

5 x 1 = 5 marks

- i. Phenotypic plasticity
- ii. Phytoalexins
- iii. Osmolytes
- iv. Aquaporins
- v. Herbivory
- vi. Allelopathy

Q2. Differentiate between the following (**any three**):

3 x 5= 15 marks

- i. Abiotic and biotic stress
- ii. Pattern-triggered immunity and effector-triggered immunity
- iii. LEA proteins and HSPs
- iv. Mutation breeding and protected cultivation

Q3. Write short notes (**any three**):

3 x 5= 15 marks

- i. Ion homeostasis
- ii. Systemic acquired resistance (SAR)
- iii. Role of NO in stress signalling
- iv. Stress-tolerant genetically engineered plants

Q4. (a) Discuss the physiological and biochemical responses of plants to drought stress. 8 marks

(b) What are antioxidant enzymes? Discuss their role in plant stress tolerance. 7 marks

Q5. (a) What are reactive oxygen species (ROS)? Explain their role in plant stress biology.

7 marks

(b) What are secondary metabolites? Discuss the role of any one class of secondary metabolites in tolerance against environmental stress.

8 marks

Q6. (a) Discuss in detail the role of Absciscic Acid (ABA) in stomatal regulation and how it mediates drought tolerance.

8 marks

(b) What are calcium-binding proteins? Explain calcium-mediated stress signalling responses in plants?

7 marks

(19)

Serial No of Q.P : 8587
Unique Paper Code : 2163010022
Name of the Paper : Plant Genomics, Proteomics and Bioinformatics
Name of the Course : Botany
Semester : VIII
Duration : 2 hours
Maximum Marks : 60 Marks

Instructions for Candidates

1. Write your Roll No. on the top immediately on the receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any four questions in all.
4. All parts of a question should be answered together.
5. Draw diagrams wherever required.

Q1. (a). Match the following items (any five): 1x5= 5

- | | |
|--------------------------------------|------------------------|
| a. File format | i. PubMed |
| b. E-value | ii. Protein Structure |
| c. Search engine | iii. Genomics ethics |
| d. Literature database | iv. FASTA |
| e. X-ray crystallography | v. Sequence similarity |
| f. Privacy, data sharing, and equity | vi. Entrez |

(b). Define the following terms briefly (any five): 1x5= 5

- a. Epigenomics
- b. Clade
- c. Bioinformatics
- d. Metabolomics
- e. Proteome
- f. Molecular Phylogeny

(c). Expand the following (any five): 1x5= 5

- a. IIMP
- b. NCBI
- c. nLC-MS/MS
- d. BLAST
- e. KEGG
- f. PDB

Q2. Write short notes on any three of the following: 3x5 = 15

- a. CRISPR-Cas9
- b. Genome complexity
- c. Scope of Bioinformatics
- d. Post translational modifications

Q3. Differentiate between (any three):

3x5 = 15

- a. Primary and Secondary biological databases
- b. Primary and Tertiary structure of proteins
- c. Genomics and Proteomics
- d. ChIP seq and Bisulphite sequencing

Q4. a. Describe the workflow of proteome analysis using MALDI-ToF with well labelled Diagram.

8

b. What is a biological database? Discuss one nucleotide databases in detail with their features.

7

Q5. a. What do you understand by metagenomics? Explain its basic concept with well labelled Diagram and applications.

8

b. Explain the workflow of homology modeling in bioinformatic including key steps of model building and validation.

7

(20)

[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **9266** **I**

Unique Paper Code : 2163010024

Name of the Paper : Plant Stress Biology

Name of the Course : **Botany**

Semester : VIII

Time : 2 Hours **Maximum Marks : 60**

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Attempt **four** questions in **all**.
- Question No. **1** is compulsory.
- All** questions carry equal marks.
- Draw well labelled diagrams wherever necessary.

1. (a) Expand the following (any five): 5×1=5

(i) LEA

(ii) MAPK

(iii) AQPs

(iv) SA

(v) SOD

(vi) HSPs

P.T.O.

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(b) Match the following : $5 \times 1 = 5$

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|----------------------|---|
| (i) HSP70 | (a) Detoxification of H_2O_2 |
| (ii) Catalase | (b) Wound and herbivory signalling |
| (iii) Calmodulin | (c) Quaternary ammonium osmoprotectant |
| (iv) Glycine betaine | (d) Calcium Sensor |
| (v) Jasmonic acid | (e) Chaperone induced by temperature stress |

(c) Fill in the blanks (any **five**) : $5 \times 1 = 5$

- (i) One of the mechanisms to evade drought stress in plants is to produce more which helps in stabilizing the membranes and enzymes.
- (ii) *Atriplex nummularia* is an example of
- (iii) of a plant is the heat-killing temperature depending upon the time of exposure.
- (iv) The antioxidant enzyme that converts hydrogen peroxide to water and oxygen in peroxisomes is
- (v) the most ubiquitous second messenger is involved in drought and salt stress signalling pathway.

- (vi) Transgenic alfalfa (*Medicago* sp.) overexpressing tobacco Mn SOD shows enhanced tolerance to stress.
2. Differentiate between (any **three**) : $3 \times 5 = 15$
- (i) Acclimation vs Adaptation
 - (ii) Salt exclusion vs Salt tolerance
 - (iii) Alkaloids and Phenolics
 - (iv) Biotrophs vs Necrotrophs
3. Write notes on the following (any **three**) : $3 \times 5 = 15$
- (i) Late embryogenesis abundant proteins
 - (ii) Hypersensitive response
 - (iii) Mechanism of Salicylic acid signalling during plant stress
 - (iv) Traditional and modern methods of crop improvement
4. (a) Discuss the osmotic and cytotoxic effects of salinity stress in plants. 8
- (b) Discuss the role of nitric oxide (NO) in stress sensing and signalling mechanisms in plants. 7

5. (a) Describe the zig-zag model in plant defense with the help of suitable diagrams. 8
- (b) Explain temperature stress in plants. Discuss the role of heat shock proteins in stress tolerance mechanisms. 7
6. (a) What is osmotic stress? Elaborate on the mechanism of various ion transporters during salinity stress in plants. 8
- (b) Give a brief account of stress-tolerant genetically engineered plants. 7
