

25/04/2028

(2.30 Hours)

Total Marks : 75

- N.B.: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat labelled diagrams wherever necessary.
4) Use of non-programmable calculator is permitted.

- Q.1 Choose the correct option from the following: (Any fifteen) 15
1. Starch is type of -----.
A. Oligosaccharide B. Monosaccharide C. Disaccharide D. Polysaccharide
 2. Cellulose microfibril arrange themselves into thicker bundles called-----
A. Fibers B. Chitin C. Pectin D. Fructose
 3. ----- are organic compound formed mainly from alcohol and fatty acids.
A. Sugar B. Protein C. Lipids D. Nucleic acid
 4. The inhibitors bind reversibly with enzyme site other than active site in case of ----- inhibition.
A Competitive B. Non- competitive C. Uncompetitive D. Normal reaction
 5. ----- catalyze group transfer reaction, excluding oxireductases.
A. Transferases B. Oxireductases C. Hydrolyses D. Lyases
 6. The nodule forming bacteria are:
A. Azotobacter B. Nitrobacter C. Clostridium D. Rhizobium
 7. Growth regulators, which control plant growth and development are called _____
A. Secondary metabolites B. Macro element
C. Nonessential elements D. Phytohormone
 8. ----- is the stress hormone of the plant.
A Brassinosteroid B. Abscisic acid C. Cytokines D. Ethylene
 9. ----- hormones is known to promote maleness in flowering plants.
A. Gibberellic acid B. Kinetin C. IAA D. 2,4 D
 10. Ammonium is oxidized to nitrite followed by the oxidation of nitrite to nitrate is called _____.
A. Nitrogen fixation B. Nitrification C. Denitrification D. Nitrogen assimilation
 11. The mutation occurring in gametes is called _____ mutation.
A. Somatic B. germinal C. cell D. chromosomal

12. The one gene one enzyme hypothesis was proposed by _____.
A. Griffith B. Mendel C. Ames D. Garrod
13. Genetic linkage refers to:
A. Genes located on different chromosomes
B. Genes inherited independently
C. Genes located close together on the same chromosome
D. Genes that mutate frequently
14. X-rays mainly cause mutations by:
A. Changing protein structure directly
B. Breaking DNA strands and causing base changes
C. Increasing cell division rate
D. Synthesizing new genes
15. The Ames test determines the _____ effect of a compound.
A. Mutagenic B. Mitogenic C. Apoptotic D. Potential carcinogenicity
16. Regression is used to:
A. Compare means
B. Study relationship between two variables
C. Count frequencies
D. Test proportions
17. One-way ANOVA is used to compare:
A. Two means
B. Three or more means
C. Two variables
D. Percentages
18. Paired t-test is used when:
A. Samples are independent
B. Same samples are measured twice (before and after)
C. Data is categorical
D. Sample size is large
19. Unpaired t-test is used for:
A. Same group before and after
B. Two different groups
C. More than three groups
D. One sample only
20. What does the acronym ANOVA stand for?
a) Analysis of Variables
b) Analysis of Variance
c) Automated Numerical Optimization and Validation
d) Average of Variance

Q. 2 Answer the following questions: (ANY TWO)

15

- A) Explain the structure amylose and amylopectin of starch in detail.
B) What are amino acids? Classify amino acids on the basis of their R-Groups.
C) Describe Michaelis Menten equation in detail.
D) What is enzyme inhibition? Describe any two types of inhibition.

- Q. 3 Answer the following questions: (ANY TWO) 15**
- A) Explain in detail the steps involved in the formation of root nodules in pea plant.
 - B) Describe the mechanism of ammonia assimilation in plants.
 - C) Give a brief account of Auxins as a plant growth regulator.
 - D) Explain the role of Nitrate Reductase and Nitrite Reductase in N₂ fixation.

- Q. 4 Answer the following questions: (ANY TWO) 15**
- A) What are point mutations? Explain frameshift mutations with suitable examples.
 - B) Explain mutations induced by 5BU with an illustration.
 - C) Discuss the metabolic disorder Phenyl ketone urea.
 - D) In cucumber plants, three recessive traits—**spiny fruit surface (s)**, **tuberculate fruit (tu)**, and **uniform green colour (u)**—are controlled by genes located on the same chromosome. A plant heterozygous for all three genes (**S U Tu / s u tu**) was crossed with a triple recessive tester (**s u tu / s u tu**). The following offspring were obtained:

Phenotype	Number of Offspring
S U Tu	88
s u tu	82
S u tu	22
s U Tu	16
S U tu	20
s u Tu	18
S u Tu	2
s U tu	2
Total	250

Questions

- a. Identify the correct **gene order** on the chromosome.
- b. Calculate the **recombination frequencies** and construct a **genetic map** showing distances between the genes.

Q. 5 Answer the following questions: (ANY TWO)

A) A student is studying the relationship between leaf length (X in cm) and leaf width (Y in cm) in a plant species. Calculate regression coefficients b_{xy} and b_{yx}

X (Leaf Length)	2	4	6	8	10
Y (Leaf Width)	1	3	5	7	9

B) An experiment was conducted to compare the germination percentage of seeds in control soil and bio fertilizer-treated soil for *Vigna radiata*. The summary statistics are given below:

Control group: $n_1 = 10$, Mean = 52, SD = 4

Treated group: $n_2 = 12$, Mean = 58, SD = 5

The pooled variance is given as $Sp^2 = 21$.

Test whether there is a significant difference between the two groups at the 5% level of significance using an unpaired t-test. The table value of t at 5% level (two-tailed) for 20 degrees of freedom is 2.086.

C) A researcher studied the effect of a short exercise session on pulse rate (bpm) of five individuals. Measurements were taken before and after exercise.

Subject No	1	2	3	4	5
Before (bpm)	82	88	90	85	87
After (bpm)	78	84	86	82	83

Use a paired t-test to determine whether the reduction in pulse rate is statistically significant. (Given $t_{0.05,4} = 2.78$)

D) A botanist studied the effect of different fertilizers on plant height (cm) of *Pisum sativum* under controlled conditions. Three fertilizer treatments were used: organic, inorganic, and mixed.

Organic	Inorganic	Mixed
45	52	58
47	54	60
46	53	59

Perform one-way ANOVA to test whether fertilizer type significantly affects plant height. Use 5% level of significance. Table value of F at 5% level for df (2, 6) is 5.14. State your conclusion.

(2 Hrs 30 min)

[Total Marks:75]

N.B.: 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labelled diagrams wherever necessary.

Q. 1) Choose the correct option from the following and rewrite the sentence (ANY 15) 15

1. The main attraction of Indian Botanic Garden is _____
 - a. Mango tree
 - b. Palms
 - c. Cactus house
 - d. Great Banyan Tree
2. Lloyd's Botanic Garden is located at _____
 - a. Howrah
 - b. Darjeeling
 - c. Bangalore
 - d. Dehradun
3. Hutchinson published his famous work in a book entitled _____
 - a. Genera plantarum
 - b. Families of flowering plants
 - c. History of plants
 - d. World plantarum
4. Staminal corona is a distinguishing characteristic of family _____
 - a. Lamiaceae
 - b. Asclepiadaceae
 - c. Rhamnaceae
 - d. Cannaceae
5. Verticillaster inflorescence seen in family _____
 - a. Asclepiadaceae
 - b. Combretaceae
 - c. Labiatae
 - d. Rhamnaceae
6. The reduction of supporting or mechanical tissue is the characteristic of _____
 - a. Hydrophytes
 - b. Mesophytes
 - c. Xerophytes
 - d. Epiphytes
7. _____ is the example of non-succulent xerophyte.
 - a. Aloe
 - b. Opuntia
 - c. Nerium
 - d. Mango
8. _____ are salt-tolerant plants that grow in waters with high salinity.
 - a. Hygrophytes
 - b. Halophytes
 - c. Epiphytes
 - d. Hydrophytes
9. _____ is the characteristic feature of *Avicennia*.
 - a. Poor development of roots
 - b. Guttation
 - c. Presence of clinging roots
 - d. Presence of salt gland
10. *Peperomia* is an example of _____
 - a. Sciophytes
 - b. Halophytes
 - c. Epiphytes
 - d. Hydrophytes
11. Double fertilization is a process unique to _____
 - a. Gymnosperms
 - b. Angiosperms
 - c. Bryophytes
 - d. Pteridophytes
12. The tube cell of a pollen grain forms the _____
 - a. Pollen tube
 - b. Embryo sac
 - c. Endosperm
 - d. Ovule

13. In a circinotropous ovule, the funicle and the micropyle are _____.
- At the same end
 - At opposite ends
 - At right angles to each other
 - In the same plane
14. The endosperm in coconut is _____.
- Nuclear
 - Cellular
 - Both nuclear and cellular
 - Neither nuclear nor cellular
15. The tapetum is a type of _____.
- Parenchyma
 - Collenchyma
 - Sclerenchyma
 - Meristem
16. _____ refers to diversity of habitats over the total landscape or geographical area.
- Alpha
 - Beta
 - Gamma
 - Sigma
17. Western Himalaya is rich in _____ flora.
- Rhododendron*
 - Lantana*
 - Acanthus*
 - Ixora*
18. _____ plants minimize damage from waves and floods.
- Grasses
 - Conifers
 - Thorny shrubs
 - Mangrove
19. Diversity among species in an ecosystem is called _____ diversity.
- Alpha
 - Species
 - Beta
 - Genetic
20. Which of the following plant is dominant in Himalyan dry temperate forest?
- Pinus*
 - Acanthus*
 - Acacia*
 - Mangifera*

Q. 2) Answer the following questions (ANY TWO)

15

- Describe the working of the Botanical Survey of India and add a note on its regional branches.
- Give the systematic position with reasons, distinguishing characters, and one economic importance of the family Cannaceae.
- Explain with neat and labelled diagrams, the morphological features of the family Euphorbiaceae. Give any one economic importance and floral formula.
- Discuss in brief Hutchinson's system of classification. State its merits and demerits.

Q. 3) Answer the following questions (ANY TWO)

15

- Citing suitable examples, describe the morphological and anatomical adaptations shown by submerged hydrophytes towards the aquatic ecosystem.
- What are Epiphytes? With suitable examples, describe the modifications seen in epiphytes.
- Highlight the typical anatomical adaptations of Hygrophytes with a suitable example.
- With the help of a suitable example, explain the modifications shown by succulent Xerophytes.

- Q. 4) Answer the following questions (ANY TWO)** **15**
- a) What is double fertilization? Describe the process with the help of a neat, labeled diagram.
 - b) Explain in detail the process of Megasporogenesis in angiosperms.
 - c) What is Microsporogenesis? Explain the process of development of a male gametophyte in Angiosperms
 - d) Describe the process of development of monosporic embryo sac.
- Q. 5) Answer the following questions (ANY TWO)** **15**
- a) With reference to biodiversity, describe the different levels of biodiversity.
 - b) What is phytogeography? Discuss any 3 phytogeographical regions of India
 - c) Define conservation. State its importance. Add a note on Ex-Situ type of conservation.
 - d) Define genetic diversity. Add a note on the molecular methods used for assessing genetic diversity.

Duration 2 Hrs 30 Minutes

Total Marks: 75

- N.B.:**
1. All questions are compulsory.
 2. Figures to the right indicate full marks.
 3. Draw neat and labeled diagram wherever necessary.

Q. 1 Choose the correct option from the following and rewrite the sentence (**Any fifteen out of 20**) **15**

- 1 Pyrosequencing is a method of DNA sequencing is based on the _____ principle.
 - a sequencing by cleavage
 - b sequencing by polymerization
 - c sequencing by synthesis
 - d sequencing by denaturation
- 2 DNA barcodes consist of a standardized short sequence of DNA _____.
 - a 100-200 bp
 - b 200-400 bp
 - c 400-800 bp
 - d 1000-10000 bp
- 3 Klenow fragment of DNA polymerase is used in sequencing because this lacks the _____ activity.
 - a 5'→3'exonuclease
 - b 5'→3'endonuclease
 - c 3'→5'exonuclease
 - d 3'→5' endonuclease
- 4 Which of the following is not the application of DNA barcoding in plants?
 - a Speciation
 - b Identification
 - c Conservation
 - d Characterization
- 5 DNA fragment to be sequenced is end-labelled by the addition of _____.
 - a 32 P-dATP
 - b 15N-dATP
 - c 32P- dCTP
 - d 15N- dCTP
- 6 Which of the following scientists created the first Bioinformatics database?
 - a Dayhoff
 - b Pearson
 - c Richard Durbin
 - d Michael. J. Dunn
- 7 All are sequence alignment tools except _____.
 - a BLAST
 - b FASTA
 - c Clustal W
 - d Rasmol
- 8 The first secondary database developed was _____.
 - a PRINTS
 - b PROSITE
 - c PDB
 - d PIR
- 9 SIB and EBI collaboratively maintained the following protein database.
 - a MIPS
 - b SWISS-PROT
 - c PIR
 - d PDB
- 10 Scoring matrix commonly used in BLAST is _____.
 - a PAM Matrix
 - b BLOSUM 80
 - c BLOSUM 62
 - d MD Matrix
- 11 Melting point of fat is _____ and melting point of oil is _____.
 - a Higher, higher
 - b Lower, lower
 - c Higher, lower
 - d Lower, higher
- 12 In solvent extraction, _____ is used as a solvent for dissolving oil.
 - a Alcohol
 - b Ether
 - c Benzene
 - d Water

- 13 In _____, the fruit or plant is manually or mechanically pressed until all the oil is squeezed out.
a Expression b Solvent extraction c Steam distillation d Maceration
- 14 Cotton seed oil is the example of _____.
a Semi-drying oil b Drying c Refined oil d Unrefined oil
- 15 In _____, flowers are spread on glass sheets coated with grease.
a Enfleurage b Solvent extraction c Steam distillation d Maceration
- 16 In osmotic drying _____ are generally used as a solute for fruits and vegetables.
a Vinegar, sugar b Table salt, sugar c Sugar syrup, brine d Citric acid, vinegar
- 17 Sun drying method in fruits and vegetables involves sterilization by _____.
a Concentrated sugar solution b Concentrated salt solution c X-rays d UV radiations
- 18 In Liquid immersion freezing, which of the following liquid used as refrigerant which are known as cryogenes?
a Liquid Nitrogen b Skimmed milk c Water d Mineral oil
- 19 Which of the following ingredient is not added in jelly?
a Sugar b Pectin c Acid d Salt
- 20 Blast freezing is the process of _____.
a Pushing cold air at high velocity b Removing moisture c Adding of cold water d Hot water treatment

Q. 2 Answer the following questions (Any two).

- a) Describe Dideoxy chain termination method of DNA sequencing. 7.5
- b) Discuss the steps involved in polymerase chain reaction technique. 7.5
- c) Describe the use of rbcL gene sequence in DNA barcoding. 7.5
- d) What is DNA barcoding? Describe the basic features of sequences used for DNA barcoding. 7.5

Q. 3 Answer the following questions (Any two).

- a) Discuss in detailed about DDBJ and GenBank as nucleic acid databases. 7.5
- b) Describe BLAST as a retrieval tool of biological data. 7.5
- c) How does comparison of protein structure help in function prediction? 7.5
- d) What is Phylogenetic analysis? How does it explain the evolution of organisms and organs? 7.5

Q. 4 Answer the following questions (Any two).

- a) Explain the method used for extracting essential oil from fresh flowers of Rose. Give an account on benefits of Rose oil. 7.5
- b) Explain the extraction process for Sandalwood oil. Give its uses. 7.5
- c) Define drying oil. Write the botanical name, plant part used, extraction process and uses of Linseed oil. 7.5
- d) What are vegetable fats? Write the botanical name, plant part used, extraction procedure and uses of Coconut oil. 7.5

Q. 5 Answer the following questions (Any two).

- a) With respect to drying method of preservation, explain vacuum drying and crystallised fruit. 7.5
 - b) With respect to food preservation, describe cryogenic freezing and freeze drying. 7.5
 - c) What are antioxidants? Discuss the role of antioxidants in food preservation. 7.5
 - d) Explain in detail about canning and pickling as methods for the preservation of fruits and vegetables. 7.5
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- 16 The plant *Thuja* belongs to the group _____.
 a) cycadales b) coniferales c) gnetales d) ginkgoales
- 17 Male reproductive structures in gymnosperms are called _____.
 a) flowers b) cones or strobili c) fruits d) capsules
- 18 The male reproductive structures in *Gnetum* are called _____.
 a) Ovules b) Antheridia c) Microsporangiate cones d) Megasporeangiate cones
- 19 The dominant habitat of *Ephedra* species is _____.
 a) Deserts and semi-arid regions b) Tropical rainforests
 c) Arctic tundra d) Wetlands
- 20 The gymnosperm *Ginkgo biloba* is used primarily for _____.
 a) Timber production b) Medicinal purposes, especially in improving memory
 c) Resin extraction d) Paper manufacturing

- Q.2 Attempt any two of the following** 15
- A. Describe the structure of the antheridiophore of *Marchantia*. 7.5
- B. Give a brief account on sporophyte of *Marchantia*. Draw a neat, labelled diagram. 7.5
- C. Describe the internal structure of *Pellia* thallus and add a note on its systematic position. 7.5
- D. Explain the external morphology of the leafy gametophyte of *Sphagnum*. 7.5

- Q.3 Attempt any two of the following** 15
- A. Describe different types of steles seen in different species of *Lycopodium*. 7.5
- B. With the help of a neat labelled diagram, describe the L.S. of the strobilus of *Equisetum*. 7.5
- C. Describe the external morphology of *Adiantum*. Add a note on its systematic position. 7.5
- D. Explain the internal structure of *Marsilea* Sporocarp. 7.5

- Q.4 Attempt any two of the following** 15
- A. Explain the Progressive theory of evolution of the gametophyte in Bryophytes 7.5
- B. "Bryophytes are bioindicators of air pollution." Explain, giving suitable examples. 7.5
- C. With the help of neat labelled diagrams, explain different types of sori found in Pteridophytes. 7.5
- D. Give an account on economic importance of Pteridophytes 7.5

- Q.5 Attempt any two of the following** 15
- A. With the help of a suitable diagram, describe the T.S. of the young stem of *Thuja*. 7.5
- B. Give a detailed account of the structure of the staminate strobilus of *Ephedra*. Add a note on microsporangium & microspores. 7.5
- C. Explain the structure of the female cone of *Gnetum*. Add a note on the V.S. of the ovule 7.5
- D. Enlist and explain the major economic benefits of gymnosperms. 7.5