UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 6th Semester Examination, 2023

DSE-P3-BOTANY

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.

The paper contains Paper-1, Paper-2, Paper-3, Paper-4, Paper-5, Paper-6, Paper-7, Paper-8 and Paper-9. The candidates are required to answer any *one* from the *nine* papers except the one attempted at DSE4. Candidates should mention it clearly on the Answer Book.

PAPER-1

ANALYTICAL TECHNIQUES IN PLANT SCIENCES

GROUP-A

1.	Answer any *five* questions from the following:	1×5 = 5

(a) What is Svedberg unit? — 1

(b) What is homogenization? — 1

(c) What is pulse chase experiment? — 1

(d) Briefly mention the role of marker enzymes in cell fractionation. — 1

(e) How is population mean different from sample mean? — 1

(f) Explain why, salts of heavy metals are used as stain in electron microscopy. — 1

(g) Enumerate two important features of an ideal stationary phase in column chromatography. — $\frac{1}{2} + \frac{1}{2}$

(h) State the wavelengths used for detection of nucleic acids and proteins in a spectrophotometer. — $\frac{1}{2} + \frac{1}{2}$

GROUP-B

2.	Answer any *three* questions from the following:	5×3 = 15

(a) State the working principle of ion-exchange chromatography. Mention two applications and two limitations of the method of ion-exchange chromatography. — 1+2+2

(b) Mention the points of differences between: — $2\frac{1}{2} + 2\frac{1}{2}$
(i) AGE and PAGE
(ii) Primary data and Secondary data.

(c) What is resolving power of a microscope? Describe in brief, the principle of working of a compound microscope. — 1+4

(d) Mention the different types of chromosome banding techniques in brief. — 5

(e) What is Mean Deviation? How is it different from Standard Deviation? Calculate the mean deviation from the following: — 1+1+3

X	10	11	12	13	14
F	3	12	18	12	3

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

    (a) Differentiate between: 5+5
        (i) Freeze Etching and Freeze Fracturing
        (ii) Fluorescence microscopy and Confocal microscopy.

    (b) Explain the principle of working of the spectrophotometer with reference to the Beer-Lambert law. What are the applications of visible and UV spectrophotometer? 6+4

    (c) Using a ray diagram, explain the working principle of TEM. Discuss, in detail, the methods used for sample preparation in electron microscopy. 4+6

    (d) What is Blotting? Explain the technique of Southern Blotting in detail, with the help of flowcharts and labeled diagram. 2+8

PAPER-2

BIOINFORMATICS

GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

    (a) What is Entrez?
    (b) Expand KEGG.
    (c) Name a multiple sequence alignment tool.
    (d) What is PSA?
    (e) What is Swiss-Prot?
    (f) Briefly explain what you understand by 'tblastx'.
    (g) What is TAIR-BLAST?
    (h) Why is bioinformatics considerd as an interdisciplinary subject?

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

    (a) Differentiate between: $2\frac{1}{2} + 2\frac{1}{2}$
        (i) Composite and Secondary Database
        (ii) PSI-BLAST and RPS-BLAST.

    (b) Write a short note on the aim and the scope of bioinformatics. 5
    (c) Write a short note on derivative databases of NCBI. 5
    (d) Explain the term 'scoring matrices' with special emphasis on BLOSUM and PAM. 5
    (e) Write a note on the applications of bioinformatics in drug designing. 5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

    (a) What are the various available tools for sequence analysis in EMBL? Give a schematic diagram of steps involved in sequence submission on EMBL database. 4+6

    (b) What is molecular phylogeny? By what methods is it measured? Explain – 'Consistency of Molecular Phylogenetic Prediction'. 2+3+5

    (c) What is fasta? What is pdb? How are these two data formats different from each other? How can one use 'fasta' format as input to generate 'pdb' files as a search result while doing 'blastp'? 2+2+3+3

    (d) (i) Differentiate between structural studies in bioinformatics and studies of sequences in bioinformatics. 6+4
        (ii) Differentiate between the sequence databases found in the websites of NCBI, EMBL and DDBJ.

PAPER-3
STRESS BIOLOGY
GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

(a) Define the term 'photoinhibition'.   1

(b) What is oxidative stress?   1

(c) Expand IP_3 and DAG. $\frac{1}{2} + \frac{1}{2}$

(d) Name two non-enzymatic antioxidants. $\frac{1}{2} \times 2$

(e) Mention two membrane proteins that are involved in salt tolerance response. $\frac{1}{2} \times 2$

(f) What are osmoprotectants? Give an example. $\frac{1}{2} + \frac{1}{2}$

(g) Define the term 'necrotrophic pathogen' with the help of examples.   1

(h) How does the phenomenon of tolerance differ from resistance?   1

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

(a) Give a brief account of Systemic Acquired Resistance.   5

(b) Discuss the different physiological defence mechanisms found in plants.   5

(c) Discuss the different roles of salicylic acid in management of biotic stress in plants.   5

(d) Give an account on the calcium modulation in plants during stress.   5

(e) Write a short note on the mediation of insect as well as disease resistance by jasmonates.   5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

(a) What are the different types of abiotic stress? Discuss the mechanism of abiotic stress management in plants by ABA.   4+6

(b) Give an account on pathogenesis related (PR) proteins with reference to their role in plant defence mechanism.   10

(c) Write short notes on: 5×2 = 10
    (i) Compatible solutes
    (ii) Xerophytic adaptation.

(d) What do you mean by acclimation? Elucidate the role of salt transporters in providing salinity tolerance to plants with suitable diagrams.   2+8

PAPER-4
PLANT BREEDING
GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

(a) Define germplasm.

(b) What is heteromorphism?

(c) Name two vegetatively propagated crop plant.

(d) What do you mean by herkogamy?

(e) What is mutation breeding?

(f) What do you mean by primary introduction?

(g) Name one gene bank of India.

(h) Define mass selection.

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

(a) Define polygenic inheritance. Explain it with suitable example.   1+4

(b) Discuss about the contrivances and consequences of self-pollination in crop-plants. $2\frac{1}{2}+2\frac{1}{2}$

(c) What is emasculation? Briefly describe the methods of emasculation.   1+4

(d) Define heterosis. How is the phenomenon utilized in plant breeding?   1+4

(e) Write a note on application of auto-polyploidy in crop improvement.   5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

(a) What is inbreeding-depression? Discuss about the genetic basis of inbreeding-depression. Mention its demerits.   2+4+4

(b) Discuss about various methods of hybridization in self and cross-pollinated plants.   5+5

(c) Compare mass-selection and pureline selection. Point out the merits and demerits of both the methods.   5+5

(d) Distinguish between   5+5
   (i) Pedigree method and Bulk method
   (ii) Dominance hypothesis and Over-dominance hypothesis.

PAPER-5

NATURAL RESOURCE MANAGEMENT

GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

(a) Define 'Silviculture'.

(b) Write two advantages of solar energy.

(c) What do you mean by in-situ conservation?

(d) Define sustainable development according to Brundtland Report.

(e) What is geothermal energy?

(f) What do you mean by 'Green building'?

(g) List two traditional system of water harvesting.

(h) Write the full form of IUCN.

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

(a) Write down different causes of forest depletion. Give two examples of non-renewable sources of energy.   3+2

(b) Write a short note on CBD.   5

(c) What is sacred groove? Describe the role of community in forest and wildlife conservation.   1+4

(d) What are the criteria for designating biodiversity hotspot? Discuss the biodiversity hotspots of India.   2+3

(e) Write short note on 'solid waste management'.   5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

(a) Write down the significance of EIA in resource management. Briefly describe the horticultural approach for utilization of land. 6+4

(b) Give a general account on major and minor forest products. What are the different techniques of forest management process? 3+3+4

(c) Briefly describe the major threats to fresh-water and marine-ecosystem. Write down various management strategies to restore and conserve fresh-water and marine ecosystem. 6+4

(d) Write short notes: 5+5
   (i) Intellectual Property Right
   (ii) Ecological foot-print.

PAPER-6

HORTICULTURAL PRACTICE AND POST-HARVEST TECHNOLOGY

GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

   (a) Write full form of IARI.
   (b) Name any two branches of Horticulture.
   (c) What do you mean by furrow-irrigation?
   (d) Name an Indian National body related to food-safety.
   (e) What do you mean by crop-sanitation?
   (f) Mention botanical names of two fruit crops of North Bengal.
   (g) State one deficiency symptom of Zinc.
   (h) Name one important biopesticide that can be used in horticulture.

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

   (a) What do you mean by food-irradiation? Mention its merits and demerits. 2+3
   (b) Discuss the main features of marigold. Give its botanical name and family. 3+1+1
   (c) What is hydroponics? Discuss about its scope in India. 2+3
   (d) What do you mean by documentation and conservation of germplasm of Horticultural plants? How is it important in Horticultural practices? $2\frac{1}{2}+2\frac{1}{2}$
   (e) Name some national and international horticultural societies along with their contributions in promoting Horticulture and Post-harvest technologies. 5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

   (a) Discuss about origin and distribution of mango. Briefly describe the crop and its economic products. 2+2+6
   (b) Define landscaping. Elaborate different aspects of landscaping of parks. 2+8
   (c) Write an essay on methods of minimizing loses during storage and transportation of horticultural crops. 5+5
   (d) What are the scopes and limitations in seed propagation method in case of fruits? Write a brief note on scope of urban horticulture in India. 6+4

PAPER-7
RESEARCH METHODOLOGY
GROUP-A

1. Answer any *five* questions from the following: 1×5 = 5

    (a) What is Normality?
    (b) Name a chemical which is used for tissue maceration.
    (c) Name a species which can be used as model organism in genetic analysis.
    (d) What do you mean by fundamental research?
    (e) Define peel mount.
    (f) Name one chemical fixative for tissue preparation.
    (g) Give one example of 'acidic dye'.
    (h) Write the full form of GFP.

GROUP-B

2. Answer any *three* questions from the following: 5×3 = 15

    (a) Mention the importance of application of scale bar in tissue imaging. 5
    (b) Write short note on: Plagiarism. 5
    (c) Discuss the principles of maintaining laboratory notebook. 5
    (d) Discuss about differences between physical and chemical fixation of tissues. 5
    (e) Give a brief account of safety measures in handling toxic chemical. 5

GROUP-C

3. Answer any *two* questions from the following: 10×2 = 20

    (a) Discuss about different types of graphs used in research with suitable examples. 10
    (b) Write short notes on: 5+5
        (i) Abbreviations and nomenclature used in scientific writing
        (ii) Poster presentation.
    (c) When do you use microtome? Describe the procedure for preparing paraffin block with the material. Mention the demerits of microtome. 2+6+2
    (d) Write down the significance of staining in the field of biological research. Classify stain depending on their chemistry. Write a short note on fluorochrome. 2+6+2

PAPER-8
INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY
GROUP-A

1. Answer any *five* of the following questions: 1×5 = 5

    (a) Define biomagnification.
    (b) What is solid state fermentation?
    (c) Name two fungal species used in citric acid production.
    (d) What is the importance of baffles in an aerobic fermenter?
    (e) Why TOC of water is important?
    (f) What is Hartig Net?
    (g) What is an indicator organism?
    (h) What do you understand by bacteroid?

GROUP-B

2.   Answer any ***three*** of the following questions: 5×3 = 15

   (a) Describe the method of enzyme immobilization with reference to Penicillin and   5
       Acylase.

   (b) Discuss the process of isolation of micro-organism from soil.   5

   (c) Give an account on Ion-Exchange Chromatography.   5

   (d) Differentiate between endomycorrhiza and ectomycorrhiza.   5

   (e) What is a bioreactor used for? Name a commonly used bioreactor and mention its   2+1+2
       components.

GROUP-C

3.   Answer any ***two*** of the following questions: 10×2 = 20

   (a) What is biological nitrogen fixation? Describe the process of root nodule formation   1+7+2
       in legume plants. Write down the significance of biological Nitrogen fixation.

   (b) Write short notes on: 5+5
       (i) Microbes as indicator of water quality
       (ii) TDS of water sample.

   (c) What is sewage? Discuss in detail the steps involved in sewage treatment.   1+9

   (d) What is semisynthetic penicillin? How does it differ from biosynthetic penicillin?   1+2+7
       Describe the process of penicillin production.

PAPER-9

BIOSTATISTICS

GROUP-A

1.   Answer any ***five*** questions from the following: 1×5 = 5

   (a) Define sampling.

   (b) What is Sturges Rule?

   (c) What do you mean by regression co-efficient?

   (d) What is class limit?

   (e) Define Geometric Mean.

   (f) What is cumulative frequency?

   (g) State the difference between qualitative and quantitative data.

   (h) Define degree of freedom.

GROUP-B

2.   Answer any ***three*** questions from the following: 5×3 = 15

   (a) What is Mode? Calculate Mode from the following data.   2+3

X	50	55	60	65	70	75	80	85	90
f	5	8	14	15	15	12	9	8	4

   (b) Why $(n-1)$ is used to calculate the standard deviation when sample size is small?   2+1+2
       What is co-efficient of variance? Write down the formula for calculating variance.

   (c) State the difference between co-relation and regression.   5

(d) In Mendelian dihybrid cross, following result was observed: 5

Round yellow seeds	312
Round green seeds	110
Wrinkled yellow seeds	104
Wrinkled green seeds	34

Calculate the chi-square (χ^2) and interpret the result (χ^2 for 3 df at 5% level of significance = 7.81).

(e) Define statistical table. What are the different parts of a table? State the essential features of a good statistical table. 1+2+2

GROUP-C

3. Answer any **two** questions from the following: $10 \times 2 = 20$

(a) Following data relate to increase in dry weight of the pods of a plant after particular treatment. Calculate the mean, standard deviation and standard error from the following distribution. 10

Observation	1	2	3	4	5	6	7	8	9	10
Increase in dry wt.	4.25	4.20	4.15	3.35	3.25	4.70	3.25	3.75	3.70	3.90

(b) Point out the different measures of Central tendency and differentiate them. Find the mean and standard deviation of the following distribution. 4+3+3

Class Interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	10	15	18	20	17	14	6

(c) Mendel fertilized pea-plants with round and yellow peas. In the next generation he recovered the following number of peas. 8+2

315 round and yellow peas

108 round and green peas

101 wrinkled and yellow peas

32 wrinkled and green peas.

What is your hypothesis about the genetic control of the phenotype? Does the data support in hypothesis?

(d) In order to find the effect of biofertilizer on rice yield, rice was grown with and without fertilizer and yields were noted. 10

Plot No.	1	2	3	4	5	6	7	8	9	10
With fertilizer	15.3	15.8	16.1	17.0	15.5	16.5	16.2	15.5	17.1	16.3
Without fertilizer	14.5	13.8	15.9	13.9	14.8	14.9	15.2	15.0	14.1	13.7

Verify whether there is any significant effect of the fertilizer on the grain yield of rice.

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