

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5300

J

Unique Paper Code : 2164001002

Name of the Paper : Biofertilizers

Name of the Course : **Botany-GE**

Semester : II / 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 any **four** questions in all.
3. Question no. 1 is compulsory.
4. Attempt all parts of a question together.
5. Illustrate your answers with suitable diagrams wherever necessary.

1. (a) Define the following : (5×1=5)

- (i) Biological control
- (ii) Arbuscules
- (iii) Vermicomposting
- (iv) Nitrification
- (v) YEMA

- (b) Fill in the blanks : (5×1=15)

- (i) The digested waste excreted from earthworm is called _____ .
- (ii) AM fungus have been assigned to a new Phylum named _____ .
- (iii) Actinorrhizal symbiosis is a mutualistic relationship between certain non-leguminous plants and _____ .
- (iv) _____ is a waste treatment process that involves combustion of substances contained in waste materials.

P.T.O.

- (v) _____, a nitrogen fixing bacteria is closely associated with cereals and grasses.
- (c) True and False : (5×1=5)
- (i) Azotobacter is a non-symbiotic biofertilizer.
 - (ii) The bacteria responsible for biological nitrogen fixation are called diazotrophs
 - (iii) Vesicles act as a storage site for nutrients formed inside the root cortex.
 - (iv) Azolla is an aquatic fern.
 - (v) Dairy products, bones and fishes can be added for biocomposting.
2. Write short notes on the following (**any three**) : (3×5=15)
- (a) Phosphate solubilizing bacteria
 - (b) Organic farming
 - (c) Azolla in rice cultivation
 - (d) Stock culture
3. Attempt any **two** : (7.5×2=15)
- (i) Explain agricultural and industrial waste management emphasizing on various composting methods.
 - (ii) Give a detailed account of Nitrogen-fixing biofertilizers.
 - (iii) What are the advantages and disadvantages of using chemical fertilizers?
4. Attempt any **two** : (7.5×2=15)
- (i) What are carrier-based inoculants? Briefly discuss the properties of an ideal carrier material.
 - (ii) What is Green manuring? Write down the benefits of Green manuring.
 - (iii) With the help of a diagram describe the formation of a root nodule.
5. Briefly describe the different types of mycorrhizal association. Write down the role of mycorrhizae in growth and yield of crop plants. (15)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5966

J

Unique Paper Code : 2162521201

Name of the Paper : Genetics and Molecular Biology

Name of the Course : **B.Sc. Life Science Botany DSC**

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. Question No. 1 is compulsory
3. Attempt **four** questions in all
4. Attempt **all** the parts of a question together.

1. (a) Fill in the blanks : (1×5=5)

- (i) Chromosome theory of inheritance was given by _____ .
- (ii) Number of base pairs per turn in B-DNA is _____ .
- (iii) ORF stands for _____ .
- (iv) _____ site in the ribosome is the site where peptidyl tRNA attaches during elongation.
- (v) Alleles of different genes that are present on the same chromosome form a _____ group.

(b) Define **any five** of the following : (1×5=5)

- (i) Okazaki fragments
- (ii) DNA Polymerase
- (iii) Lethal mutation
- (iv) Duplicate genes
- (v) Replication fork
- (vi) Genetic code

P.T.O.

- (c) Match the following : (1×5=5)
- | | |
|--------------------------|---------------------------|
| (i) Gregor Johann Mendel | concept of gene |
| (ii) Watson and Crick | Mutations |
| (iii) Wilhelm Johannsen | ABO blood group |
| (iv) Hugo de Vries | Structure of DNA |
| (v) Karl Landsteiner | Principles of inheritance |
2. Write short notes on the following (**any three**) : (5×3=15)
(Draw appropriate diagrams and give examples wherever necessary)
- (i) tRNA
 - (ii) Epistasis
 - (iii) Reciprocal Translocation
 - (iv) Transposons
 - (v) Mutagens
3. Differentiate between **any three** of the following : (5×3=15)
(Draw appropriate diagrams and give examples wherever necessary)
- (i) Incomplete dominance and Co-dominance
 - (ii) Linkage and Crossing Over
 - (iii) Autopolyploidy and allopolyploidy
 - (iv) RNA polymerase I, II and III
 - (v) Positive and negative regulation of Lactose Operon
4. Explain **any three** of the following with the help of diagrams. (5×3=15)
- (i) Translation in Prokaryotes
 - (ii) Attenuation
 - (iii) Semi-discontinuous replication of DNA
 - (iv) Paracentric inversion heterozygotes and inversion bridge
5. (a) What is the central dogma of molecular biology? Explain the concept and exceptions to this dogma. (5)
- (b) What is pleiotropism? Explain how is it different from Polygenic inheritance with the help of suitable examples. (7)
- (c) State Mendel's law of independent assortment. (3)
6. (a) Describe the experiment to prove the semi-conservative mode of DNA replication. (6)
- (b) Explain the inheritance of plastids in *Mirabilis jalapa* (Four O'clock plant) with the help of suitable diagrams. (6)
- (c) Discuss in brief the *cis-trans* complementation test. (3)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5773

J

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 any **four** questions in all.
3. Question No. 1 is compulsory.
4. Attempt **all** parts of a question together.

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

- (i) Proteobacteria
- (ii) Firmicutes
- (iii) Viroid
- (iv) Bacteriorhodopsin
- (v) Biofilm
- (vi) Plasmid
- (vii) Phytoplasma

(b) Match the following : (5×1=5)

- | | |
|------------------------------|--------------------------------|
| (i) <i>Bacillus</i> sp. | a. Taq polymerase |
| (ii) <i>Rhizobium</i> | b. Rod-shaped bacterium |
| (iii) Mycoplasma | c. Symbiotic nitrogen fixation |
| (iv) T1 phage | d. Wall-less form |
| (v) <i>Thermus aquaticus</i> | e. DNA virus |

P.T.O.

- (c) Write true or false against the given statements : (5×1=5)
- (i) Angular leaf spot of cotton is caused by *Xanthomonas citri* pv. *malvacearum*.
 - (ii) Tobacco mosaic virus is a ds DNA virus.
 - (iii) Mycorrhiza is an association between a fungi and the roots of higher plants.
 - (iv) Louis Pasteur discovered the Koch's postulates.
 - (v) *Aquaspirillum magnetotacticum* perceives magnetism.
2. Differentiate between : (any three) (3×5=15)
- (a) Prototrophs and Auxotrophs
 - (b) F+ and Hfr strains
 - (c) Archaeobacteria and Eubacteria
 - (d) Spheroplasts and Protoplast
 - (e) Gram-positive and Gram-negative cell wall
3. Write short notes on the following : (any three) (3×5=15)
- (a) Generalized transduction
 - (b) Economic importance of viruses
 - (c) Plant growth promoting rhizobacteria
 - (d) Citrus canker disease
 - (e) Endomycorrhiza
4. Draw well labelled diagrams of any three of the following : (3×5=15)
- (a) Bacterial cell structure
 - (b) T2 Bacteriophage
 - (c) Lysogenic cycle
 - (d) T.S. of root nodule
5. Answer the following : (any two) (2×7.5=15)
- (a) Explain genetic transformation in bacteria. What is the transformation frequency reported for Eubacteria?
 - (b) What are the types of mycorrhiza and mention their effects on plant growth.
 - (c) Give a detailed account of any one viral disease of plants.

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5794

J

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** parts of a question must be answered together.
4. **All** questions carry equal marks.
5. Draw labelled diagrams and write the botanical name wherever necessary.

1. (a) Mention the botanical name and family of the following (**any five**) : (1×5=5)

(i) Black pepper

(ii) Fennel

(iii) Tea

(iv) Soybean

(v) Flax

(vi) Groundnut

- (b) Expand the following (**any five**) : (1×5=5)

(i) IARI

(ii) CDRI

(iii) IRRI

(iv) SBI

(v) NBPGR

(vi) CPRI

P.T.O.

- (c) Match the following (**any five**) : (1×5=5)
- | | |
|-------------------|---------------|
| (i) Cotton | (a) Retting |
| (ii) Millet | (b) Ginning |
| (iii) Jute | (c) Saffron |
| (iv) Sugarcane | (d) Ratooning |
| (v) Rice | (e) Ragi |
| (vi) Shahi Zafran | (f) Caryopsis |
2. Differentiate between the following (**any three**) : (5×3=15)
- (i) Fatty oils and essential oils
 - (ii) White jute and tossa jute
 - (iii) Black tea and green tea
 - (iv) Cereals and millets
3. Write short notes on the following (**any three**) : (5×3=15)
- (i) Products and by-products of Sugarcane Industry
 - (ii) Vavilov's concept of centres of cultivated plants
 - (iii) Importance of legumes to man and ecosystem
 - (iv) Curing of tobacco
 - (v) Processing of coffee
4. Draw well-labelled diagrams of the following giving botanical name and family (**any three**) : (5×3=15)
- (i) L.S. of Clove bud
 - (ii) C.S. of Potato tuber
 - (iii) L.S. Wheat grain
 - (iv) T.S. Citrus fruit
5. (i) Coconut is a multi-purpose plant. Comment on the statement. (5)
- (ii) Write botanical name, family, plant part used and chemical constituents of any two drug yielding plants you have studied. (5)
- (iii) Tapping of latex from para rubber tree. (5)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5814

J

Unique Paper Code : 2162011203

Name of the Paper : Plant Systematics

Name of the Course : B.Sc. (H) 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.
3. Question No. 1 is compulsory.
4. **All** questions carry equal marks.
5. Attempt all parts of a question together.

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

- (i) Indian Botanical Garden is situated at _____ city.
- (ii) Father of Botany _____ .
- (iii) *Pinax theatri botanici* is written by _____ taxonomists.
- (iv) *Theorie elementaire de la Botanique*, author of the book _____ .
- (v) Standard size of a herbarium sheet is _____ .
- (vi) Carlous Linnaeus was given the award of _____ .

- (b) Name the following : (1×5=5)

- (i) Name the Authur of *Systema naturae*.
- (ii) Name a plant name with Genus epithet, named after a place
- (iii) Name Basal Angiosperm
- (iv) An angiosperm which lacks vessels
- (v) Publishing year of Binomial nomenclature

- (c) Define the following : (**any five**) (1×5=5)

- (i) Vasculum
- (ii) Out group
- (iii) Manual
- (iv) Monophyly

P.T.O.

- (v) Heterobathmy
- (vi) Taxonomic literature

2. Differentiate between : **(any three)** (5×3=15)
- (a) Homonym, Basionym and Tautonym
 - (b) Natural and Phylogenetic system of Classification
 - (c) Holotype, lectotype and Paratype
 - (d) Phenetic and Cladistic
3. Write short notes on **(any three)** : (5×3=15)
- (a) Herbaceous origin of angiosperms
 - (b) Secondary metabolites in relation to Taxonomy
 - (c) Importance of Herbarium
 - (d) Biological species concept
 - (e) Floras
4. (a) Write a note on Characters and character coding in cladistics methodology. (7)
- (b) Discuss the role of Palynology in relation to Taxonomy with suitable example. (8)
5. (a) What is type method? Give an account of different 'types' mentioned in plant nomenclature. (5)
- (b) What is APG Classification and discuss about the various versions of APG system of classification. (5)
- (c) Interpret the following : (3)
- (i) *X Triticosecale*
 - (ii) *Triticum aestivum* L. 1753
 - (iii) *Rosa floribunda* cv. Blessings
- (d) Write alternate name and type genus of Labiatae and compositae. (2)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5692

J

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. Attempt **four** questions in all.
3. Question No. 1 is compulsory.
4. Attempt all parts of a question together.

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

5x1=5

- (a) _____ are polymers composed of the uronic acids, D-mannuronic acid and L-guluronic acid.
- (b) Iodine can be readily obtained from _____ (give botanical name of the alga/class).
- (c) _____ is a common freshwater unicellular green alga with cup shaped chloroplast.
- (d) _____ alga is responsible for red colour of snow.
- (e) _____ is a monomeric sugar alcohol used by brown seaweeds as a reserve food.
- (f) _____ is a unicellular green alga which contains large amounts of β -carotene, glycerol, and protein and it can be cultured in highly saline water.

P.T.O.

- (g) Algae often float on the surface of water during the day but sink down during the night due to the evolution and trapping of _____ during photosynthesis.
- (h) _____ is a model marine alga used to study alternation of generations.

(B) Match the following (**any five**)

(5×1=5)

- | | |
|-----------------------------|---------------|
| a) <i>Porphyra</i> | Agar |
| b) <i>Haematococcus</i> | Carrageenan |
| c) <i>Gracilaria</i> | Nori |
| d) <i>Kappaphycus</i> | Space food |
| e) <i>Chlorella</i> | Beta-carotene |
| f) <i>Dunaliella salina</i> | Pond Silk |
| g) <i>Spirogyra</i> | Astaxanthin |

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

(5×1=5)

- (a) MUFA
- (b) ESW Medium
- (c) DDT
- (d) PAR
- (e) BOD
- (f) ROS
- (g) PAH

2. Briefly describe (**any three**) (5×3=15)

- (a) Pharmaceutical application of algae
- (b) Algal Biorefinery
- (c) Nutritional value of seaweeds
- (d) Algae as fodder
- (e) Role of nanotechnology in algal research

3. Giving one example, define **any ten** : (10×1.5=15)

- (a) Seaweed liquid extract
- (b) Mannitol
- (c) Shellfish poisoning
- (d) Phyco-bioremediators
- (e) Single cell protein
- (f) Algal symbiosis
- (g) Algal Bioplastic
- (h) Bioluminescence
- (i) Pollution Indicator
- (j) Red tides
- (k) Secondary metabolites
- (l) Raft culture of seaweeds

4. Attempt **any three** of the following : (3×5=15)

- (a) With the help of a suitable diagram explain various part of *Acetabularia*.

- (b) Draw a well labelled diagram of a typical raceway pond
- (c) Briefly discuss various application of Diatomaceous Earth
- (d) Algal biofertilizers
- (e) Gene sequencing and algal systematics

5. Answer **any two** of the following : (2×7.5=15)

- (a) Explain briefly any five major water pollutants, along with their sources, harmful effects, and name the algae, which can be used for their remediation.
- (b) Algae are a crucial component in various cosmetics and the nutraceutical industry. Justify this statement by providing suitable examples from both microalgae and macroalgae.
- (c) Define biofuels and their various generations. Emphasize the advantages and challenges faced by the algal biofuel industry, providing suitable examples.

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5300

J

Unique Paper Code : 2164001002

Name of the Paper : Biofertilizers

Name of the Course : Botany-GE

Semester : II / 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 any **four** questions in all.
3. Question no. 1 is compulsory.
4. Attempt all parts of a question together.
5. Illustrate your answers with suitable diagrams wherever necessary.

1. (a) Define the following : (5×1=5)

- (i) Biological control
- (ii) Arbuscules
- (iii) Vermicomposting
- (iv) Nitrification
- (v) YEMA

- (b) Fill in the blanks : (5×1=15)

- (i) The digested waste excreted from earthworm is called _____ .
- (ii) AM fungus have been assigned to a new Phylum named _____ .
- (iii) Actinorrhizal symbiosis is a mutualistic relationship between certain non-leguminous plants and _____ .
- (iv) _____ is a waste treatment process that involves combustion of substances contained in waste materials.

P.T.O.

- (v) _____, a nitrogen fixing bacteria is closely associated with cereals and grasses.
- (c) True and False : (5×1=5)
- (i) Azotobacter is a non-symbiotic biofertilizer.
 - (ii) The bacteria responsible for biological nitrogen fixation are called diazotrophs
 - (iii) Vesicles act as a storage site for nutrients formed inside the root cortex.
 - (iv) Azolla is an aquatic fern.
 - (v) Dairy products, bones and fishes can be added for biocomposting.
2. Write short notes on the following (**any three**) : (3×5=15)
- (a) Phosphate solubilizing bacteria
 - (b) Organic farming
 - (c) Azolla in rice cultivation
 - (d) Stock culture
3. Attempt any **two** : (7.5×2=15)
- (i) Explain agricultural and industrial waste management emphasizing on various composting methods.
 - (ii) Give a detailed account of Nitrogen-fixing biofertilizers.
 - (iii) What are the advantages and disadvantages of using chemical fertilizers?
4. Attempt any **two** : (7.5×2=15)
- (i) What are carrier-based inoculants? Briefly discuss the properties of an ideal carrier material.
 - (ii) What is Green manuring? Write down the benefits of Green manuring.
 - (iii) With the help of a diagram describe the formation of a root nodule.
5. Briefly describe the different types of mycorrhizal association. Write down the role of mycorrhizae in growth and yield of crop plants. (15)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5664

J

Unique Paper Code : 2162012403

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

Name of the 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. **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.

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

- (a) _____ is a commonly used clearing agent.
- (b) Sclereids with dilated ends resembling bones are called _____.
- (c) Lateral roots originate from _____.
- (d) Histogen theory was given by _____.
- (e) Sugarcane leaves show special type of anatomy known as _____.
- (f) Water secretion from margins of leaves occur through pores called _____.
- (g) _____ is a specialized parenchyma cell which is associated with a sieve tube element and arises from the same mother cell.

— (5×1=5) —

B. Define the following (any **five**):

- (a) Transfer cells
- (b) Rhytidome
- (c) Bulliform cells
- (d) Phloem wedges
- (e) Periderm
- (f) Maceration
- (g) Quiescent centre

(5×1=5)

P.T.O.

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

- (a) Needle shaped crystals of calcium oxalate found in many plants.
- (b) The time interval between the formation of one leaf primordium and the next
- (c) In wood, elements of xylem are blocked by balloon-like ingrowths.
- (d) Vascular bundles with phloem on either side of xylem.
- (e) A multicellular epidermal layer found around orchid roots consisting of dead cells with lignified secondary cell walls.
- (f) Suberin thickening bands in endodermal cells.
- (g) Phloem patches enclosed within secondary xylem. (5×1=5)

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

- (a) Classification of stomata by Metcalfe and Chalk
- (b) Seasonal activity of cambium
- (c) Secretory system in plants
- (d) Korper-Kappe theory
- (e) Application of Plant Anatomy in Forensics (3×5=15)

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

- (a) Monocot and dicot stem
- (b) Tracheids and Vessels
- (c) Sapwood and Heartwood
- (d) Stratified and Non-stratified Cambium (3×5=15)

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

- (a) V.S. *Zea mays* leaf
- (b) T.S. *Helianthus* root
- (c) V.S. of *Ficus* leaf showing lithocyst
- (d) L.S. of Root Apex (3×5=15)

5. (a) Describe the structure and function of simple tissues with well labelled diagrams. (8)

(b) Discuss secondary growth in dicot stem along with suitable diagrams. (7)

6. (a) What are the characteristic features of meristematic cells? Give a brief account of any three theories for the organization of Shoot Apical Meristem. (8)

(b) Give a detailed account of anatomical adaptations in stem of a xerophytic plant with well labelled diagram. (7)

5. (a) Give a brief account on regulation of population density. Discuss in detail r-selected and k- selected populations. (3+4=7)
- (b) What are biogeochemical cycles? What roles biogeochemical cycles play in an ecosystem? Discuss carbon cycle in detail with the help of a well labelled outline diagram. (1+2+5=8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5585

J

Unique Paper Code : 2162012402

Name of the Paper : Ecology and Conservation

Name of the Course : **B.Sc. (H) 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) Define the following (any six) : (1.5x 6=9)

(a) Pedogenesis

- (b) Carrying capacity
- (c) Photoperiodism
- (d) Water table
- (e) Sacred groves
- (f) Continental drift
- (g) Field capacity
- (h) Phytogeography

(b) Match the following : (1x6=6)

- | | |
|---------------------|----------------------------------|
| (i) Ecotone | (a) Cryopreservation |
| (ii) Gene banks | (b) Genetically fixed variations |
| (iii) Ecotypes | (c) Partially decomposed litter |
| (iv) Mortality rate | (d) Mangroves |
| (v) Duff | (e) Edge effect |
| (vi) Halophytes | (f) Survivorship curves |

2. Differentiate between (any five) : (3x5=15)

- (a) Primary productivity and secondary productivity

- (b) Food chain and food web
- (c) Artificial and natural ecosystems
- (d) Heliophytes and sciophytes
- (e) Gravitational water and capillary water
- (f) Palaeoendemics and neo-endemics
- (g) Alluvial and colluvial soil

3. Write short notes on the following (any three) : (5x3=15)

- (a) Theory of tolerance
- (b) Synthetic characters of a community
- (c) In situ and ex situ conservation strategies
- (d) Negative biotic interactions
- (e) Thermal stratification in water bodies

4. (a) What is ecological succession? Explain the general process of succession. (7)

- (b) What is soil profile? Explain the various horizons with the help of a suitable diagram. (8)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5525

J

Unique Paper Code : 2162012401

Name of the Paper : Mycology

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

Semester : IV – DSC

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. **First** question is compulsory.
3. **All** parts of questions must be answered together.

1. (a) Define the following citing an example (**any five**). (1×5=5)

- | | |
|-----------------------|-----------------------|
| (i) Capillitium | (ii) Soredia |
| (iii) Rhizomorph | (iv) Biotrophic fungi |
| (v) Crozier formation | (vi) Dolipore septa |
| (vii) Haustoria | |

- (b) Fill in the blanks. (0.5×10=5)

- (i) Parasexuality was discovered by _____ .
- (ii) _____ is also known as the Drosophila of the fungus world.
- (iii) Amphigynous antheridial development is seen in the genus _____ .
- (iv) Perfect stage of *Penicillium* is _____ .
- (v) Spore bearing layer of fungal tissue is called _____ .
- (vi) Potato wart is caused by _____ .
- (vii) *Neurospora* is commonly known as _____ .
- (viii) _____ is an example of fungus that forms fairy rings.
- (ix) _____ is the most common fungicide for control of fungal disease in plants.
- (x) _____ is a common fungus used for myco-remediation.

- (c) Match the following. (1×5=5)

- | | |
|--------------------------|----------------------------|
| (i) Nematophagous fungus | <i>Trichoderma</i> |
| (ii) Mycoparasite | <i>Penicillium</i> |
| (iii) Edible Ascomycete | <i>Arthrotrichum</i> |
| (iv) Blue mould | <i>Rhizopus stolonifer</i> |
| (v) Fumaric acid | <i>Morchella</i> |

P.T.O. (

2. Draw a well labeled diagram of the following (**any three**) : (5×3=15)
- (i) Sectional view of sexual reproductive structure of *Peziza*.
 - (ii) An enlarged view of sporangium of *Stemonitis*.
 - (iii) Section through basidiocarp of *Agaricus* showing enlarged view of gills.
 - (iv) V.S. of leaf showing asexual reproductive stage in *Albugo*.
 - (v) *Saccharomyces* vegetative cell - Electron micrograph.
3. Write notes on any **three** of the following. Draw proper diagrams wherever necessary. (5×3=15)
- (i) Hyphal modifications in fungi.
 - (ii) Mushroom cultivation.
 - (iii) Bioluminescence.
 - (iv) Sexual reproduction in *Rhizopus* sp.
 - (v) Mycotoxin.
4. Differentiate between the following (**any three**) : (5×3=15)
- (i) Cleistothecium and Perithecium
 - (ii) Zygosporangium and Oosporangium
 - (iii) Holocarpic and Eucarpic Fungi
 - (iv) Ectomycorrhizae and Endomycorrhizae
 - (v) Unstratified and stratified thallus in Lichens
5. (a) "Black Stem Rust Disease" caused by a fungus, completes its life cycle on two different host plants. Elaborate with the help of illustrations. Write the name of the fungus, its two different host species (Botanical name), symptoms and all the spore stages. Write the main reason for the re-occurrence of wheat rust in India? (10)
- (c) Write a short note on different species of edible mushrooms in reference to their nutrition value. (5)
6. (a) Elaborate the role of fungi in pharmaceutical industry. (5)
- (b) Explain the vegetative state of myxomycetes and its various types with examples. (5)
- (c) Oomycetes are considered as a separate group of organisms from the true fungi? Elaborate. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5565

J

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. Attempt four questions in all.
3. Question No. 1 is compulsory.
4. All questions carry equal marks

1. (a) Write the role of **(any five)**: (5)

(i) Bis-acrylamide in PAGE

(ii) Monochromator

(iii) Immersion oil

(iv) Electron gun

P.T.O.

(v) Osmium tetroxide

(vi) Primer

(b) True or false (**any five**): (5)

(i) Separation of molecules in paper chromatography is based on liquid-liquid partitioning.

(ii) SEM require higher electric power (voltage) than TEM.

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

(iv) Western blotting is used for the separation and analysis of RNA.

(v) Both, *Taq* and *Pfu* DNA polymerase are thermostable.

(vi) G-banding shows darker bands at G/C rich region of the chromosome.

(c) Match the following: (5)

(i) Spectrophotometer (a) Tswett

(ii) Electron Microscope (b) Edwin

(iii) Chromatography (c) Knoll and Ruska

(iv) Ultracentrifugation (d) Beer and Lambert

(v) Southern blotting

(e) Svedberg

2. Discuss the following **(any three)**: (3x5= 15)

- (a) Selection of cuvette during Visible, UV and IR spectrophotometry.
- (b) How and why temperature, pH and osmotic potential are regulated during tissue homogenization?
- (c) What is centrifugation force? Discuss the factors on which it depends.
- (d) FISH Technique and its application.

3. Discuss the following **(any three)**: (3x5= 15)

- (a) Discuss the importance and limitations of freeze fracture technique.
- (b) What is negative staining? Give an example.
- (c) Selection of sucrose or caesium chloride as density gradient medium.
- (d) Discuss the key steps involve in PCR Technique

4. (a) With the help of suitable diagram briefly discuss the principle, functioning and applications of Column chromatography. (10)

- (b) What are radioisotopes? Name any three radioisotope elements used in biological research. Give an example for each. (5)

5. (a) What is DNA polymorphism? Briefly explain the techniques and applications of RFLP, and AFLP. (10)
- (b) Role of SDS and TEMED in PAGE. (5)
6. What are the differences between Southern, Northern, and Western blotting techniques? Briefly describe their applications. (15)

Sr. No. of Question Paper : 2573

Unique Paper Code : 42167904

Name of the Course : B. Sc. Life Sciences

Name of the Paper : Analytical Techniques in Plant Sciences

Semester : VI

Duration: 3 Hours

Maximum Marks: 75

Instructions for Candidates:

- 1. Write your Roll No. on the top immediately on receipt of this question paper.**
- 2. Attempt five questions in all. Question No. 1 is compulsory.**
- 3. All questions carry equal marks.**
- 4. Illustrate your answers with labeled diagrams.**
- 5. All parts of a question must be answered together.**

Q1. a) Expand the following (any five): (5 X 1= 5)

- i) MALDI
- ii) SDS-PAGE
- iii) RCF
- iv) FISH
- v) ELISA
- vi) TLC
- vii) GFP

b) Define (*any five*) (5 X 1= 5)

- i) R_f
- ii) Fluorochromes
- iii) Half Life
- iv) Magnification
- v) Chromosome painting
- vi) Cryofixation
- vii) Blotting technique

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

- i) The pore size can be regulated by increasing or decreasing the concentration of _____ in AGE.
- ii) _____ is the commonly used material as stationary phase in thin layer chromatography.
- iii) The marker enzyme for mitochondria is _____.
- iv) The magnification of a microscope having 4X ocular lens and a 40X objective lens would be _____X.

v) Osmium tetroxide is used in electron microscopy as a _____.

vi) The DNA molecules are immobilized on the _____ in southern blotting technique.

Q2. Write short notes on any three of the following

5x3=15

- i) Shadow Casting
- ii) Affinity Chromatography
- iii) Applications of Radioisotopes in research
- iv) Marker Enzymes

Q3. Differentiate between the following (any five):

3x5=15

- i) Chromosome banding and painting
- ii) Northern and southern blotting
- iii) Positive and negative staining
- iv) Thin layer chromatography and column chromatography
- v) Sucrose and caesium chloride gradient chromatography
- vi) Light and electron microscopy

Q4. (a) Explain the procedure and applications of the Polymerase Chain Reaction.

(5)

(b) Briefly explain the sample preparation for electron microscopy.

(5)

(c) Explain the pulse-chase experiment in detail with an example.

(5)

Q5. Attempt any **three** of the following:

(3 X 5 =15)

- a) Discuss the working and applications of flow cytometry.
- b) Give a brief account of DNA fingerprinting.
- c) Explain the principle and applications of spectrophotometry.
- d) Briefly explain shadow casting technique.

Q6. Give reasons for the following statements (any five).

(5 X 3

=15)

- a) The electron microscope column is maintained under high vacuum during operation.
- b) TEMED and APS should be added just before casting of gel.
- c) Glycerol and bromophenol blue is added to the DNA by loading it onto the gel.
- d) Carbohydrates and lipids cannot be separated by electrophoresis.
- e) The resolving power of a microscope is inversely proportional to the wavelength.
- f) The temperature, pH and osmotic potential of the medium are very important during the homogenization of the tissue before centrifugation.
- g) Fixatives are used during sample preparation for microscopy.

Q7. (a) Briefly discuss the technique of X-ray crystallography and its applications.

(6)

(b) Explain the principle, working and applications of Western Blotting. How is it different from Northern blotting?

(9)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5865

J

Unique Paper Code : 2162523601

Name of the Paper : Economic Botany and Biotechnology

Name of the Course : Life Science

Semester : VI

Duration : 3 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 must be answered together.

1. (a) Give scientific name of the following (**any five**) : (5)

- | | |
|----------------|-------------------|
| (i) Sunflower | (ii) Black Pepper |
| (iii) Cardamom | (iv) Soybean |
| (v) Gram | (vi) Jute |

- (b) Fill in the blanks (**Any five**) (5)

- (i) Eugenol is the major constituent in the aromatic oil extract from _____ .
- (ii) Gossypol is a polyphenolic aldehyde compound present in _____ .
- (iii) DNA Fingerprinting was developed by _____ .
- (iv) _____ refers to the in vitro multiplication and regeneration of plant material under aseptic and controlled environmental conditions.
- (v) The first commercially available genetically modified food was _____ engineered to have a longer shelf life.
- (vi) Millets are the member of family _____ .

P.T.O.

- (c) Match the following : (5)
- | | |
|-------------------------|-------------------------|
| (i) Haploid Culture | (a) Cloning Vector |
| (ii) GUS | (b) Triploid plants |
| (iii) Endosperm culture | (c) Vitamin A |
| (iv) pUC19 | (d) Reporter Gene |
| (v) Golden Rice | (e) Guha and Maheshwari |
2. Write short notes on the following (**any three**) : (3×5=15)
- (i) Any one method of gene transfer in plants
 - (ii) Evolution of bread wheat
 - (iii) Selectable marker
 - (iv) Germplasm conservation
 - (v) Vavilov's centre of origin of cultivated plants
3. (a) Differentiate the following (**any three**) : (3×3=9)
- (i) Genomic and cDNA libraries
 - (ii) Black tea and green tea
 - (iii) RAPD and RFLP
 - (iv) Southern and Western Blotting
- (b) What are pulses. Enumerate the economic and ecological importance of pulses. (6)
4. (a) Draw labelled diagrams for (**any two**) (2×5=10)
- (i) L.S. Clove Bud
 - (ii) L.S. wheat Caryopsis
 - (iii) T.S. Peppercorn
- (b) Briefly explain the PCR technique. Write its applications. (5)
5. (a) Describe anther culture. Enumerate the applications of this technique. (7)
- (b) What is Golden rice? Explain the steps involved in the development of Golden rice with the help of suitable diagram. (8)

- (i) Ernst Munch
- (ii) Hugo De Vries
- (iii) Garner and Allard
- (iv) H.A. Borthwick
- (v) Darwin
- (vi) Paul. J. Kramer
- (vii) F.W. Went
- (viii) D.S. Letham

(b) Discuss the morphological and anatomical adaptations of Hydrophytes with labelled Diagram.

(8)

5. (a) Explain the transport of food and water in plants.

(8)

(b) Describe various types of tropic movements with examples.

(7)

6. (a) Explain the mechanical and chemical defence against predators with special reference to secondary metabolites.

(8)

(b) Explain the mechanisms by which plants recognize themselves, their neighbors, and their relatives. How do these recognition processes affect plant growth, competition, and cooperation within a plant community?

(7)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5042

J

Unique Paper Code : 2164001202

Name of the Paper : Intelligent Systems in Plants

Name of the Course : Common Prog. Group – GE

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, including Question No.1 which is compulsory.
3. **All** questions carry equal marks.
4. **All** parts of a question must be answered together.

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

(i) Malacophily

(ii) Osmosis

(iii) Secondary metabolites

(iv) Gibberellins

P.T.O.

(v) Plant Intelligence

(vi) Trichome

(vii) Plant Thermogenesis

(b) Fill in the blanks (**Any five**) (1×5=5)

(i) If a cell is placed in an isotonic solution, it becomes _____

(ii) The transfer of pollen grains on stigma of same flower is known as _____

(iii) The channels that perforate plant cell walls are known as _____

(iv) Succulents are commonly found in _____ Regions.

(v) The protective structure covering the shoot apex is known as _____

(vi) Carnivorous plants thrive in _____ deficient soil.

(c) Name the following (**Any five**) (1×5=5)

(i) Ions that act as second messenger in signal transduction.

(ii) Pigment responsible for the perception of blue light.

(iii) Plant produces ethylene in response to stresses such as.

(iv) An example of a plant that uses bats for pollination.

(v) The metal constituent of chlorophyll is.

(vi) The specialized motor tissue in plant leaves responsible for movement.

2. Differentiate between the following (**Any five**)

(5×3=15)

(i) Phototropism and Geotropism

(ii) Parenchyma and Sclerenchyma

(iii) Water and Heat stress

(iv) Ectomycorrhiza and Endomycorrhiza

(v) Active absorption of water and Passive absorption of water

(vi) Parasitic and Insectivorous plant

3. Write short notes on following (**Any three**) (3×5=15)

(i) Cytoplasmic streaming

(ii) Seismonastic movements in *Mimosa pudica*

(iii) Cell signalling mechanism in plants

(iv) Phytochrome

(v) Xerophytic adaptation

4. (a) Give one contribution of the following scientists (**Any seven**) (7×1=7)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5545

J

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 Number **1** is compulsory. Answer **all** parts of a question together.

1. (a) Fill in the blanks : (5x1=5)

- (i) Chemiosmotic theory for the synthesis of ATP was proposed by _____ .
- (ii) The number of ATP produced when a molecule of acetyl-CoA is completely oxidized is equal to _____ .
- (iii) Enzyme that catalyzes the cleavage of isocitrate into glyoxylate and succinate in glyoxylate metabolism is _____ .
- (iv) Emission of light of higher wavelength light by chlorophyll pigments when exposed to blue light is called _____ .
- (v) Glycolysis takes place in _____ of the plant cell.

(b) Expand the following : (5x1=5)

- (i) FAD
- (ii) LHC
- (iii) GTP
- (iv) RUBISCO
- (v) ACP

P.T.O.

- (c) Define (**Any five**) (5x1=5)
- (i) Reaction centre
 - (ii) Alpha oxidation
 - (iii) Apoenzyme
 - (iv) Absorption Spectrum
 - (v) Michaelis Menten Constant
 - (vi) Fermentation
 - (vii) Saturated fatty acids
2. Differentiate between the following (**Any five**) : (5x3=15)
- (a) Cyclic and non-cyclic photophosphorylation
 - (b) Competitive and allosteric enzyme inhibition
 - (c) Substrate level phosphorylation and oxidative phosphorylation
 - (d) Nitrate reductase and nitrite reductase
 - (e) Light reaction and dark reaction of photosynthesis
 - (f) Synthesis of sucrose and starch
3. Write short notes on the following (**Any three**) : (5x3=15)
- (a) Coupled reaction
 - (b) Ammonia assimilation
 - (c) Photorespiration
 - (d) Emerson enhancement effect
 - (e) Cyanide resistant respiration
4. (a) Explain the carbon fixation process in C₄ plants. How is it different from C₃ plants? (8)
- (b) Describe the Citric acid cycle (with the help of flowchart). (7)
5. (a) Explain oxidative pentose phosphate pathway through a schematic diagram. Give its significance to plants. (8)
- (b) Discuss the process of Beta-oxidation of fatty acids in a plant cell. (7)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5505

J

Unique Paper Code : 2162013601

Name of the Paper : Plant Biotechnology

Name of the Course : Botany: DSC 16

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 any **four** questions in all.
3. Question number **one** is compulsory.
4. Attempt all parts of a question together.

1. Answer the following questions (15)

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

- | | |
|-------------|-------------|
| (i) GUS | (ii) TALEN |
| (iii) NIPGR | (iv) CRISPR |
| (v) pUC | (vi) IAA |

- (b) Match the following (**any five**) : (1×5=5)

(i) Androgenesis	a) Gottlieb Haberlandt
(ii) Enzymatic method for protoplast isolation	b) Anand Mohan Chakrabarty
(iii) Father of Plant Tissue Culture	c) E. C. Cocking
(iv) Scorable marker	d) Sipra Guha and S.C. Maheshwari
(v) Superbug	e) GFP gene
(vi) Selectable marker	f) <i>nptII</i> gene

- (c) Define the following (**any five**) : (1×5=5)

- | | |
|-----------------|---------------------------|
| (i) Explant | (ii) Redifferentiation |
| (iii) Probe | (iv) Alkaline Phosphatase |
| (v) Totipotency | (vi) Protoplast |

P.T.O.

2. Differentiate between the following (**any three**) : (5×3=15)
- (i) Direct gene transfer and Indirect gene transfer
 - (ii) Cloning vector and Expression vector
 - (iii) Blunt-end and Sticky-end restriction endonucleases
 - (iv) Somatic hybrid and Cybrids
 - (v) Selectable marker genes and Reporter genes.
3. Write short notes on the following (**any three**) : (5×3=15)
- (i) Edible vaccines
 - (ii) Restriction endonucleases
 - (iii) Agrobacterium-mediated transformation
 - (iv) Somatic embryogenesis
 - (v) Biosafety of transgenic plants
4. Discuss in detail. (15)
- (a) Give detailed account of the process involved in development of transgenic Bt-cotton with the help of suitable diagram. Discuss its advantages and limitations. (8)
 - (b) Enumerate the detailed process of protoplast isolation and culture, along with its applications. (7)
5. Answer the following questions : (15)
- (a) A researcher working with a gene obtained the following DNA fragment sizes after digestion with the restriction enzymes EcoRI and HindIII:
 - EcoRI: 8.5 kb, 5.0 kb, 3.0 kb
 - HindIII: 9.5 kb, 6.0 kb, 1.0 kb
 - EcoRI + HindIII (double digestion): 6.0 kb, 4.0 kb, 3.0 kb, 2.5 kb, 1.0 kbUsing the above data, construct a restriction map. (8)
 - (b) Draw well-labelled diagram of (**any two**) : (3.5×2=7)
 - (i) Biolistic gene gun
 - (ii) Androgenesis
 - (iii) YAC

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8047

J

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. Attempt any four questions in all.
3. Question No. 1 is compulsory.
4. All parts of a question should be answered together.
5. Draw graphics wherever required.

1. (a) Name the appropriate research tool/method (any five): (1x5 = 5)

(a) A commonly used data analysis software/package.

(b) Statistical test for comparing means of two groups.

(c) An author-date format used for citations.

(d) A bibliographic database for science that retrieves author information.

P.T.O.

(e) A plagiarism checking software/tool.

(f) A method of data collection.

(b) Fill in the blanks (any five): (1x5 = 5)

(a) The _____ section is where the author thanks individuals or organizations that helped with the research.

(b) Any attempt/s where exclusive permission from the copyright owner is not sought is referred to as _____

(c) A _____ is an exclusive right granted for an invention.

(d) Identification of _____ is the first step in any research process.

(e) Data is often presented visually using _____ and _____

(f) The _____ strategy is used to choose a subset of population under study for data collection.

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

(a) Plagiarism

(b) Citation

(c) Geographical Indication

(d) Validation

(e) Research Design

2. (a) Define research and discuss the different methods of data collection with suitable examples. (10)

(b) Explain the Protection of Plant Varieties and Farmers' Rights Act in India with reference to intellectual property rights. (5)
3. Write short notes for any three (cite examples): (3x5 = 15)

(a) Data representation

(b) Literature review and its significance

(c) Biopiracy

(d) Importance of grants and fellowships in research
4. Differentiate between the given terms (*any three*): (3x5 = 15)

(a) Research Methods and Research Methodology

(b) Trademark and Copyright

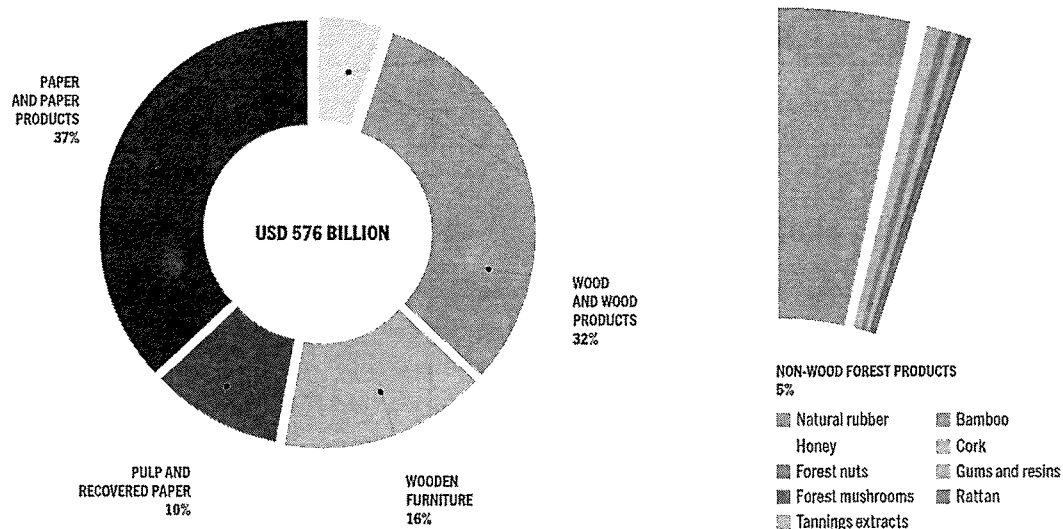
(c) Research Paper and Review Paper

(d) Correlation and Regression
5. Discuss the key features of the IMRAD format of research paper explaining the content of each section. (15)
6. Answer the following questions based on the following graphic:

(a) Write a paragraph explaining the graphic (200 words). (9)

(b) Interpret the data highlighting key findings. (6)

SHARE OF GLOBAL FOREST PRODUCT EXPORTS, BY PRODUCT CATEGORY, 2022



NOTE: Wood = unprocessed wood (roundwood, also called "wood in the rough"; it includes logs, pulpwood, other industrial roundwood and woodfuel); wood products = all transformed/processed products except furniture (charcoal, chips, pellets and briquettes, sawnwood, panels and further processed wood products such as prefabricated wooden houses, doors and window frames). Wooden furniture is also a wood product but is shown here as a separate category.

SOURCES: FAO. 2023. FAOSTAT: Forestry Production and Trade. [Accessed on 29 December 2023]. <https://www.fao.org/faostat/en/#data/FO>.

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and UN Comtrade. 2023. United Nations Commodity Trade Statistics Database. [Accessed on 29 December 2023].

<https://comtradeplus.un.org/>