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

   (i) Disposal of hazardous waste

   (ii) Culture media: types and applications

   (iii) Herbarium

   (iv) Fire extinguisher

4. (a) Explain the process of serial dilution and how it is used to estimate the concentration of microorganisms in a sample. Include the steps involved and an example calculation. (8)

   (b) Detail the working principle of Spectrophotometer and writes its applications. (7)

5. (a) What is sampling? Briefly describe the different sampling methods? (7)

   (b) What is standard error? Compute the mean, standard deviation, standard error and coefficient of variation of the following data that showed increase in the length of pods of a plant after treatment with a hormone.

Observation	1	2	3	4	5	6	7	8	9	10
Length of pod	4.25	4.20	4.15	3.35	3.25	4.70	3.25	3.75	3.70	3.90

(8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1392 **I**

Unique Paper Code : 2162011103

Name of the Paper : Basic Laboratory and field skill in Plant Biology

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

Semester : I

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) State True or False of the following **(any five)** : (5×1=5)

   (i) Agarose gel electrophoresis mainly used to separate nucleic acids based on the molecular size.

   (ii) The median and the mode of the following data is 44, 49, 44, 54, 42 is 42

(iii) Using a fume hood without ventilation is an example of bio-safety measures.

(iv) PCR is a technique to amplify the DNA of a sample.

(v) Number of moles of solute present in one liter of the solution is called Molality.

(vi) The goal of fixation is to keep the cells or specimen in the living state for longer duration.

(vii) Condenser lens collects the electron beam coming out of specimen after interaction and bends them to magnify the image in electron microscope.

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

(i) HEPA (ii) BOD

(iii) SEM (iv) PAGE

(v) HPLC (vi) EDTA

(vii) YEB

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

(i) _____ in confocal microscope blocks out-of-focus light from above and below the focal point.

(ii) To prepare 500 mL of a 2% (v/v) ethanol solution, you would need _____ mL of ethanol.

(iii) _____ is a measure of data spread or dispersion.

(iv) _____ is a catalogue to collect and preserve plant specimens.

(v) _____ is used to analyses and present the data in organized manner.

(vi) _____ is a workstation used to create a contamination-free and sterilized environment through filters to capture all the particles entering the cabinet.

(vii) _____ incubator is a specialized equipment used to measure the amount of oxygen consumed by microorganisms in wastewater samples.

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

(i) LR grade and AR grade chemicals

(ii) Light microscope and Electron Microscope

(iii) Pour plate and spread plate technique

(iv) MS excel and power-point

(v) Micrometer and Hemocytometer

(vi) Agarose and SDS-PAGE gel electrophoresis

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

   (i) General characteristics of Bryophytes

   (ii) Economic importance of bacteria

   (iii) Thallus organization and reproduction in *Nostoc*

   (iv) Sexual reproduction in *Vaucheria*

5. (a) Briefly describe different stages in the life cycle of *Puccinia*. (5)

   (b) Discuss Gametangial copulation in *Rhizopus*. (5)

   (c) Write a short note on morphology of *Equisetum*. (5)

6. (a) Why *Cycas* is known as living fossil? Briefly explain reproduction in *Cycas*. (3+7=10)

   (b) Write a note on the role of unilocular sporangia in life cycle of *Ectocarpus*. (5)

7. (a) What is alternation of generations? Explain it with reference to the life cycle of *Funaria*. (2+5=7)

   (b) Write a note on asexual reproduction in *Penicillium*. Briefly explain its economic importance. (5+3=8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6292 **I**

Unique Paper Code : 42161101

Name of the Paper : Biodiversity (Microbes, Algae, Fungi and Archegoniates)

Name of the Course : **B.Sc. (P) Life Science**

Semester : I

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, including Question no. **1** which is compulsory.
3. **All** questions carry equal marks.
4. Draw diagrams wherever required.

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

   (i) Prophage

(ii) Wanderplasm

(iii) Rhizophore

(iv) Gemma cup

(v) Rhizomorph

(vi) Circinate venation

(b) Fill in the blanks : (1×5=5)

(i) A plant body without differentiation of true leaf, root and stem is called _____ .

(ii) _____ was the first virus ever discovered.

(iii) _____ is an example of a unicellular green alga.

(iv) Hygroscopic spindle-like structures that help in spore dispersal in *Marchantia* sporophyte are called _____ .

(v) Motile reproductive asexual spores in algae are called _____ .

(c) Match the following : (1×5=5)

(i) Hornwort	A) *Puccinia*
(ii) Sanjeevani	B) *Alternaria*
(iii) Early Blight of Potato	C) *Cycas*
(iv) Stem rust of Wheat	D) *Selaginella*
(v) Sago Palm	E) *Anthoceros*

2. Distinguish between the following : (3×5=15)

(i) Heterocyst and Akinete

(ii) Uredosorus and Teleutosorus

(iii) *Marchantia* sporophyte and *Funaria* sporophyte

(iv) Lytic cycle and Lysogenic cycle

(v) Conjugation and Transduction

3. Draw well labelled diagram (**any three**) : (5×3=15)

(i) L.S. Mature female cone of *Pinus*

(ii) V.S. Sporophyll of *Pteris*

(iii) Ultrastructure of *Chlamydomonas*

(iv) Structure of T-phage

(iv) Essential oils, along with the botanical name, family, part used and uses with reference to sandalwood

(v) Key measures to protect the forests

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

(i) Why is biodiversity important for sustainable development?

(ii) Explain how sugarcane serves as a petro-crop, and its significance in renewable energy production in India.

(iii) Discuss the economic and ecological importance of Algae and Bryophytes.

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

(i) Discuss the roles, importance and key provisions of CBD.

(ii) Compare the traditional methods and innovative approaches of waste minimization during product formation.

(iii) Discuss the economic significance of cash crops.

(iv) Write a brief account of various types of forests in India, and their ecological and aesthetic utilization.

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3503 **I**

Unique Paper Code : 2164001001

Name of the Paper : Plant Diversity and Human Welfare

Name of the Course : **B.Sc. (H) Botany (GE-1)**

Semester : I

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 must be answered together.
5. **All** questions carry equal marks.

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

   (i) Extinct species

   (ii) Biodiversity

   (iii) Species richness

   (iv) Vegetation stands

   (v) Cash crops

   (vi) Agrobiodiversity

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

   (i) Botanical name of Sarpagandha is .....

   (ii) International Day of Biodiversity (IDB) is celebrated on .....

   (iii) Sandalwood is obtained from .....

   (iv) Most of the commercial sugar is obtained from the .....

   (v) Plant known as king of spices is .....

   (vi) Family of *Ocimum sanctum* is .....

   (c) Match the following : (1×5=5)

(i) Cotton	(a) Spice
(ii) Ashwagandha	(b) Petro Crop
(iii) Corn	(c) *Cocos nucifera*
(iv) Saffron	(d) Ginning
(v) Coconut	(e) Medicine

2. Write the botanical name, family, useful part and economic uses of any three of the following : (5×3=15)

   (i) Tobacco

   (ii) Saffron

   (iii) Basmati rice

   (iv) Sugarcane

   (v) Pigeon pea

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

   (i) Protection of Plant Varieties and Farmer's Right Authority (PPVFRA)

   (ii) Sustainable Development Goals (SDGs)

   (iii) Spices production in India

(iv) Type method

(v) Common features of gymnosperms

4. (a) Draw well-labelled diagrams of the following (any **two**) : (2×5=10)

(i) V. S. gill of *Agaricus*

(ii) V.S. of *Marchantia* thallus through gemma cup

(iii) EM of bacterial cell

(b) Interpret the following citations (any **two**) : (2×2.5=5)

(i) *Lupinus* [Tourn.] L.

(ii) *Cerasus cornuta* Wall. ex Royle

(iii) *Vallisneria natans* (Lour.) Hara

5. (a) Enlist the different methods of genetic recombination in bacteria. Explain any one of them. (5)

(b) Give an account of adaptation of land habit in bryophytes. (5)

(c) Give an outline of Bentham & Hooker's System of classification up to series level. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1564 **I**

Unique Paper Code : 2162521101

Name of the Paper : Plant Diversity and Systematics

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

Semester : I

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, **first** question is compulsory.
3. **All** questions carry equal marks.
4. Attempt **all** parts of the questions together.
5. Draw well-labelled diagrams wherever necessary.

P.T.O.

1. (a) Expand the following (any **three**) : (3×1=3)

   (i) Hook.f.

   (ii) A.DC.

   (iii) ICN

   (iv) *nom. nud.*

   (v) nom. nov.

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

   (i) Transfusion tissue

   (ii) Mycorrhiza

   (iii) Coenobium

   (iv) Cleistothecium

   (v) Plasmid

   (vi) Heterocysts

   (c) Fill in the blanks : (5×1=5)

   (i) Fungal cell wall is predominantly made up of a polysaccharide known as ———————.

   (ii) The name of order ends with suffix _____.

   (iii) Trabeculae are present in the sporophyte of _____.

   (iv) The alternate name of the family Cruciferae is _____.

   (v) Evolutionary history of an organism is known as _____.

   (d) What will be the name of the genus commemorating the following persons? (2×1=2)

   (i) Linnaeus

   (ii) Clarke

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

   (i) Lytic and lysogenic cycle

   (ii) Raceme and Catkin inflorescence

   (iii) Archaebacteria and Eubacteria

   (iv) Bryophytes and Pteridophytes

   (v) Natural and artificial system of classification

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

   (i) Sexual reproduction in *Rhizopus*

   (ii) Binomial nomenclature

   (iii) Asexual reproduction in *Penicillium*

P.T.O.

(ii) *Rhizopus* showing asexual reproduction

(iii) V.S Receptacle of *Sargassum* showing bisexual conceptacle

(iv) Morphology of Basidiocarp of *Agaricus*

(v) Morphology of Male cone of *Gnetum*

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

(i) Scalariform conjugation of *Spirogyra*

(ii) Bacterial genetic recombination by Transduction

(iii) Characteristic features of Fungi

(iv) Bryophytes as amphibians of plant kingdom

(v) General features of Viruses

5. Attempt any **two** from the following :

(a) Explain the affinities of Slime molds with Fungi. (7.5)

(b) With the help of diagrams, explain briefly the gametophore of *Marchantia.* (7.5)

(c) What is heterospory? Explain giving one example. (7.5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1353 **I**

Unique Paper Code : 2162011101

Name of the Paper : Plant Diversity and Evolution

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

Semester : I

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. Draw well labelled diagrams wherever necessary.

1. (a) Name the genus having the following (Attempt any **five**) : (1×5=5)

(i) Air bladder

(ii) Ligule

(iii) Fairy Ring

(iv) Foliose Lichen

(v) Gemma cup

(vi) Maidenhair fern

(vii) Spiral Chloroplast

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

(i) The term algae was coined by .....

(ii) The reserve food material of red algae is .....

(iii) Engler and Prantl system of classification is an example of ..... system of classification.

(iv) Infectious piece of RNA without protein coat is .....

(v) The number of capsomere in TMV is .....

(vi) True vessel is found in the Gymnosperm .....

(vii) Obliquely placed septa are found in rhizoids of .....

(c) Match the following : (1×5=5)

(i) Peltate Columella	(a) *Polysiphonia*
(ii) Heterotrichous thallus	(b) *Funaria*
(iii) Scales	(c) *Rhizopus*
(iv) Collar	(d) *Marchantia*
(v) Operculum	(e) *Gnetum*

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

(i) Pteridophytes and Gymnosperms

(ii) TMV and Bacteriophage

(iii) Gram-positive and Gram-negative bacteria

(iv) Natural and Artificial classification

(v) Megasporophyll and Microsporophyll of *Selaginella*

3. Draw the well labelled diagram of the following (Attempt any **three**): (5×3=15)

(i) Diagrammatic sketch of Bacterium

(iv) T.S. of periderm showing Lenticels

(v) T.S. of *Casuarina* stem

4. Write notes on any **FIVE** (5x3=15)

(i) Shoot Chimeras

(ii) Endodermis

(iii) Quiescent Center

(iv) Growth Rings

(v) Cystolith

(vi) Applications of Plant Anatomy in Forensic science

5. (a) Describe the characteristic features of meristematic tissues? Mention the different types of meristematic tissues in angiosperms and write their functions. (8)

(b) Discuss various types of stomata present in angiosperms with suitable examples. (7)

6. (a) Describe the process of secondary growth in dicot stem with the help of suitable diagrams. (7)

(b) Mention different types of simple tissues and draw diagram for each type. (8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5841 **I**

Unique Paper Code : 32161301

Name of the Paper : Anatomy of Angiosperms

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

Semester : III

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. **All** question carries equal marks.
3. Attempt **five** questions in all including question no. **1** which is compulsory.
4. All parts of question must be attempted together.
5. Draw well labelled diagram wherever required in support of your answer.

1. (a) Define (5×1=5)

(i) Root cap

(ii) Glandular Trichome

(iii) Rhytidome

(iv) Bulliform Cell

(v) Tyloses

(b) Give the examples of any **FIVE** (Write one example of each) (5×1=5)

(i) A plant with sunkun stomata

(ii) A plant has bicollateral Vascular Bundle

(iii) A plant leaf has multiple epidermis

(iv) A plant has dorsiventral leaf

(v) A plant shows Kranz anatomy

(vi) A plant leaves have silica deposition

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

(i) Latex yielding cells are called _____

(ii) Aerenchyma are an adaptation of _____ plants.

(iii) _____ theory explains the organization of the root apical meristem.

(iv) P-proteins are associated with _____

(v) Study of the growth rings in the trees is called _____

(vi) Suberized casparian strip is a part of _____ in the roots of the vascular plants.

2. Differentiate between any **FIVE** sets from the following : (5×3=15)

(i) Dorsiventral and Isobilateral leaf

(ii) Brachysclereids and Osteosclereids

(iii) Xylem and Phloem

(iv) Fusiform and Ray Initials

(v) Articulate and Non–articulate laticifers

(vi) Ring Porous and Diffuse Porous

(vii) Lysogenous and schizogenous Cavity

3. Draw a well labelled diagram of any **THREE** (3×5=15)

(i) V.S. of *Nerium* leaf

(ii) T.S. of Dicot root

(iii) T.S.of monocot stem

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

   (a) Processing and uses of coffee

   (b) Legumes as poor man's meat

   (c) Centre of origin of cultivated Plants by Vavilov

   (d) Retting in Jute

5. Mention botanical name, family and draw well labelled diagram of **any three** of the following : (5×3=15)

   (a) L.S. Wheat Caryopsis

   (b) T.S. Hesperidium Fruit

   (c) V.S Clove floral bud

   (d) L.S. Cotton seed

6. Give a detailed account of **any three** of the following : (5×3=15)

   (a) Green Revolution

   (b) Tapping of Rubber

   (c) Extraction of essential oils

   (d) Byproducts of Sugarcane industry

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5895 **I**

Unique Paper Code : 32161302

Name of the Paper : Economic Botany

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

Semester : III

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 any **five** questions in all.
3. Question No. **1** is compulsory.
4. **All** questions carry equal marks.
5. All parts of a question must be answered together.

1. (a) Write the Botanical Name of **any five** of the following : (1×5=5)

   (i) Fever bark tree

   (ii) Millet

(iii) Tea

(iv) Marijuana

(v) Fennel

(vi) Sugarcane

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

(i) Ginning

(ii) Geocarpic fruit

(iii) Dimorphic branching

(iv) Caryopsis

(v) Lathyrism

(vi) Nobilization

(c) Expand **any five** of the following abbreviations : (1×5=5)

(i) SBI

(ii) CRRI

(iii) IARI

(iv) CTRI

(v) CTC

(vi) IRRI

2. Differentiate between **any five** of the following: (3×5=15)

(a) *Nicotiana tabacum* and *N. rustica*

(b) Digitalis purpurea and D. lanata

(c) Drying oil and non-drying oil

(d) Black and Green Tea

(e) Kwashiorkor and Marasmus

(f) White Jute and Tossa Jute

3. Give the botanical name, family, useful part, and three economic uses of **any five** of the following : (3×5=15)

(a) Vetiver

(b) Saffron

(c) Mustard

(d) Foxglove

(e) Para rubber

(f) Potato

(iii) Forces of Evolution

(iv) Lamarckism

3. (a) Differentiate between the following **(any three)** (3×3=9)

(i) Chemogeny and Biogeny

(ii) Darwinism and Lamarckism

(iii) Parallel evolution and convergent evolution

(iv) Anagenesis and Cladogenesis

(b) Explain the Hardy-Weinberg Principle including its limitations. (6)

4. (a) Discuss the anthropogenic causes of evolution and extinction in detail. (7.5)

(b) Explain the evolution of seed and seed habit. (7.5)

5. (a) Discuss phylogenetic evidence of evolution in plants. (7.5)

(b) Discuss the isolating mechanisms that drive speciation. (7.5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1279 **I**

Unique Paper Code : 2163012001

Name of the Paper : Evolutionary Biology of Plants

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

Semester : III

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, the **first** question is compulsory.
3. **All** questions carry equal marks.
4. Attempt all parts of the question together.

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

(i) Allopatric Speciation

(ii) Fossils

(iii) Homologous organs

(iv) Bottleneck effect

(v) Convergence in evolution

(vi) Genetic Drift

(b) Match the following : (1×5=5)

(i) The Origin of Species	(a) Presence/Absence of leaf gap
(ii) Stelar Evolution	(b) Convergent evolution
(iii) Chemogeny precedes biogeny	(c) Charles Darwin
(iv) Analogous organs	(d) Jean B Lamarck
(v) Theory of Transformism	(e) Oparin and Haldane Theory

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

(i) _____ occurs to form a fossil when cell walls become completely replaced by minerals.

(ii) Natural selection is influenced by _____ .

(iii) According to the _____, in a large, random-mating population, the genotype and allele frequencies remain constant in the absence of any evolutionary influences from one generation to another.

(iv) _____ predicts that new species evolve when a large evolutionary change takes place in short periods of time.

(v) _____ is the evolution of species caused by the geographical isolation of two or more populations of same species in an isolated geographical area.

(vi) _____ is the flow of alleles from one generation to another by means of migration or dispersion.

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

(i) Types of Stratigraphy

(ii) Natural Selection

(b) What is barr body? How is it a consequence of dosage compensation? Explain different genetic mechanisms of sex determination in living organisms. (2+2+4)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1150 **I**

Unique Paper Code : 2162012303

Name of the Paper : Genetics and Plant Breeding

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

Semester : III

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. Support your answers with well labelled diagrams wherever necessary.
5. All parts of a question should be answered together.

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

(i) Missense mutation

(ii) Monosomy

(iii) Pure line selection

(iv) Pseudodominance

(v) Lethal alleles

(vi) Penetrance

(b) Fill in the blanks. Attempt **any five** (1×5=5)

(i) The phenomenon in plant breeding where the hybrid offspring exhibits superior traits, such as increased size or yield, compared to both parents is known as _____.

(ii) In _____ genetic inheritance, neither allele is completely dominant or recessive, and both alleles contribute equally to the phenotype of the offspring.

phenotypes (black body, vestigial wings or gray body, long wings). What is the recombination frequency between these two genes? (6)

(b) What is epistasis? Explain the types of epistasis with examples. (3+6=15)

5. (a) Explain the inheritance of kappa particles in *Paramecium*. (7)

(b) Explain chloroplast and mitochondrial inheritance with suitable examples. (4+4=8)

6. (a) In a population of 1,000 individuals, 360 individuals have blue eyes (recessive trait). What are the allele frequencies for blue eyes (b) and brown eyes (B)? (7)

(iii) Interspecific hybridization

(iv) Transposable elements

(v) Chemical mutagens

(vi) Down's syndrome

4. (a) In a fruit fly, the genes for body color (**B**=black, **b**=grey) and wing size (W=long, w=vestigial) are linked. A test cross was done between a heterozygous black body, long winged fly (*BbWw*) and a homozygous recessive gray body, vestigial winged fly (*bbww*). Of the 200 offsprings produced, 180 had parental phenotypes (black body, long wings or gray body, vestigial wings) and 20 had the recombinant

(iii) The phenomenon in which a point mutation leads to the premature termination of a polypeptide chain is known as _____ mutation.

(iv) The experiment by Thomas Hunt Morgan with *Drosophila melanogaster* led to the discovery that the X chromosome carries the gene for red eyes and white eyes, demonstrating the principle of _____.

(v) A chromosomal aberration in which a segment of a chromosome is turned around 180 degrees is called _____.

(vi) In _____ speciation, speciation occurs typically due to ecological or behavioral factors without physical barriers.

(c) Match the following with their contributors **(any five)** : (1×5=5)

(i) Chromosomal Theory of Inheritance	a. William Bateson
(ii) Plant Selection Method in plant breeding	b. Watson and Crick
(iii) Linkage	c. Alfred Sturtevant
(iv) Coining of the term 'Genetics'	d. Nilsson-Ehle
(v) DNA structure	e. Theodore Boveri & Walter Sutton
(vi) Genetic Mapping	f. Thomas Hunt Morgan

2. Differentiate between **any five** of the following : (3×5=15)

(i) Complete linkage and incomplete linkage

(ii) Test cross and reciprocal cross

(iii) Polyploidy and aneuploidy

(iv) Point mutations and frame shift mutations

(v) Pure line selection and Mass selection

(vi) Maternal inheritance and maternal effect

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

(i) Dosage compensation

(ii) Mitochondrial inheritance

(iii) Significant contribution of F.E. Fritsch and M.O.P. Iyengar

(iv) Bioluminescence in algae

(v) Palmella stage in *Chlamydomonas*

4. Draw well-labelled diagrams of the following **(any three)** : (3×5=15)

(i) V.S. bisexual conceptacle of *Sargassum*

(ii) Discoid thallus of *Coleochaete*

(iii) E.M. of Heterocyst

(iv) W.m. of cystocarp of *Polysiphonia / Gracillaria*

(v) E.M. of *Chlamydomonas / Chlorella*

5. (i) Explain the alternation of generation and its significance in *Ectocarpus.* (8)

(ii) Discuss the range of thallus organization in algae. (7)

OR

Explain the reproduction in *Nostoc*? Highlight its ecological and economic importance. (7)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1074 **I**

Unique Paper Code : 2162012301

Name of the Paper : Phycology – The World of Algae

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

Semester : III

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 the questions together
5. Draw well labelled diagrams wherever necessary.

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

(i) Gas vacuole

(ii) Heterocyst

(iii) Akinete

(iv) Cystocarp

(v) Conceptacles

(vi) Eye Spot

(vii) Amylum stars

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

(i) Multiflagellate zoospores are found in _____ .

(ii) Cells in *Polysiphonia* are interconnected by _____.

(iii) Presence of Cap cells is the characteristic feature of _____ .

(iv) Iodine is extracted from _____ (Name of algae).

(v) _____ causes Rust disease of tea.

(vi) _____ are the characteristic spores of diatoms.

(vii) Rhizoids of *Chara* possess _____ *septa*.

(c) Name an algal genus for the following **(any five)** : (1×5=5)

(i) Hormogonium

(ii) False branching

(iii) Trichoblast

(iv) Androspore

(v) Spermocarp

(vi) Rolling alga

(vii) Halophilic alga

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

(i) Gongrosira stage and Plakea stage

(ii) Oogamy and Isogamy

(iii) Unilocular sporangia and plurilocular sporangia

(iv) Cyanophyceae and Rhodophyceae

(v) Nannandrous and Macrandrous species of *Oedogonium*

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

(i) Evolutionary significance of *Prochloron*

(ii) Sexual reproduction in *Chara*

P.T.O.

Sr. No. of question paper :5713
Unique paper code : 32163302
Name of the Course : **B.Sc. Botany (Hons) SEC**
Name of the Paper : Intellectual Property Rights
Semester : III
Duration : 2 hours
Maximum Marks : 38

Instructions for Candidates
Attempt **FOUR** questions in all.
Question 1 is **compulsory.**
Attempt all parts of a question together.

Q.1 (A) Give two examples for each of the following (5X1=5 marks)

a. Industrial Design
b. Copyright
c. Patent
d. Trademarks
e. Geographical indication

(B) Expand the following abbreviations (Any 3) (3X1=3 marks)

a. WIPO
b. GATT
c. PPVFR
d. TKDL
e. USPTO

(c) Write the procedure of design registration (3 marks)

Q2. Define patents in detail. What is the procedure of obtaining a patent? Describe with the help of a suitable example? (9 marks)

Q3. Geographical indication helps different products in their trade. Give your comments with at least two examples? (9 marks)

Q4. Differentiate between the following (3X3=9 marks)

A) Novelty and Inventiveness
B) Biopiracy and Bioprospecting
C) Collective mark and Certification mark

Q5. Explain the importance of protection of IPR in electronic industry with examples from Circuit boards and Integrated Chips (9 marks)

Q6. Explain what is copyright. How is it obtained? How is it different from other Intellectual Property Rights (9 marks)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3876 **I**

Unique Paper Code : 2126000002

Name of the Paper : SIRJNATMAK LEKHAN

Name of the Course : **Common Program Group : SEC**

Semester : III

Duration : 1 Hour Maximum Marks : 30

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

ਨੋਟ: ਸਾਰੇ ਭਾਗ ਕਰਨੇ ਜ਼ਰੂਰੀ ਹਨ।

ਭਾਗ ਪਹਿਲਾ

1. ਸਾਹਿਤ ਦੇ ਸਰੂਪ ਨੂੰ ਦੱਸਦਿਆਂ, ਇਸ ਦੀਆਂ ਪ੍ਰਮੁੱਖ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਬਾਰੇ ਲਿਖੋ। (10)

Explaining the forms of literature, write about its salient features.

साहित्य के स्वरूप को समझाते हुए उसकी प्रमुख विशेषताओं के बारे में लिखिए।

ਜਾਂ

ਸਾਹਿਤ ਸਿਰਜਣਾ ਦੇ ਬੁਨਿਆਦੀ ਨੁਕਤਿਆਂ 'ਤੇ ਚਰਚਾ ਕਰੋ।

साहित्य सृजन के मूल बिन्दुओं पर चर्चा करें।

Discuss the basic points of literary creation.

ਭਾਗ ਦੂਜਾ

ਨੋਟ : ਹੇਠ ਲਿਖੇ ਪ੍ਰਸ਼ਨਾਂ ਵਿਚੋਂ ਕਿਸੇ ਦੋ ਦੇ ਉੱਤਰ ਲਿਖੋ : (5X2=10)

2. ਖੁੱਲ੍ਹੀ ਕਵਿਤਾ ਕਿਸ ਨੂੰ ਕਹਿੰਦੇ ਹਨ? ਖੁੱਲ੍ਹੀ ਕਵਿਤਾ ਦੀਆਂ ਕੋਈ ਦੋ ਉਦਾਰਹਨਾਂ ਦਿਉ।

What is called a free verse? Give any two examples of free verse.

खुली कविता किसे कहते हैं? खुली कविता के कोई दो उदाहरण दीजिए।

3. ਗ਼ਜ਼ਲ ਦੇ ਜ਼ਰੂਰੀ ਤੱਤਾਂ ਬਾਰੇ ਵਿਸਥਾਰ ਪੂਰਵਕ ਚਰਚਾ ਕਰੋ।

ग़ज़ल के आवश्यक तत्वों की विस्तार से चर्चा करें।

Discuss the essential elements of Ghazal in detail.

P.T.O.

4. ਕਥਾਨਕ ਤੇ ਪਾਤਰ-ਚਿੱਤਰਣ ਦੀ ਕਹਾਣੀ ਵਿੱਚ ਕਿੰਨੀ ਅਹਿਮੀਅਤ ਹੁੰਦੀ ਹੈ ? ਵਿਸਥਾਰ ਪੂਰਵਕ ਲਿਖੋ।
How important is the plot and character-sketch in a story? Write in detail.
कहानी में कथानक और चरित्र-चित्रण कितना महत्वपूर्ण है? विस्तार से लिखिए.

5. ਨਿਬੰਧ ਅਤੇ ਕਹਾਣੀ ਵਿਚਲੇ ਅੰਤਰ ਨੂੰ ਸਪੱਸ਼ਟ ਕਰੋ।
निबंध और कहानी के बीच अंतर स्पष्ट करें।
Explain the difference between essay and story.

6. ਵਿਸ਼ੇ ਦੀ ਚੋਣ ਸਮੱਗਰੀ ਸੰਬੰਧੀ ਟਿੱਪਣੀ ਕਰੋ।
Comment on the selection of subject matter.
विषय चयन सामग्री पर टिप्पणी करें।

ਭਾਗ ਤੀਜਾ

7. ਹੇਠ ਲਿਖੇ ਪ੍ਰਸ਼ਨਾਂ ਵਿਚੋਂ ਕਿਸੇ ਦੋ ਦੇ ਉੱਤਰ ਲਿਖੋ : (5X2=10)

I. ਕਾਵਿ-ਬਿੰਬ ਨੂੰ ਪਰਿਭਾਸ਼ਿਤ ਕਰੋ।
काव्यात्मक बिम्ब को परिभाषित करें।
Define poetic image.

II. ਗੀਤ ਤੇ ਗ਼ਜ਼ਲ ਵਿੱਚ ਅੰਤਰ ਨੂੰ ਬਿਆਨ ਕਰੋ।
Explain the difference between song and ghazal.
गीत और ग़ज़ल में अंतर स्पष्ट करें।

III. ਨਿੱਕੀ ਕਹਾਣੀ ਦੀਆਂ ਕੋਈ ਪੰਜ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਬਾਰੇ ਲਿਖੋ।
लघुकथा की कोई पाँच विशेषताएँ लिखिए।
Write any five characteristics of a short story.

IV. ਭਾਸ਼ਾ ਸ਼ੈਲੀ ਸੰਬੰਧੀ ਚਰਚਾ ਕਰੋ।
Discuss about language style.
भाषा शैली के बारे में चर्चा करें।

Your Roll No.....

Sr. No. of Question Paper :6387

Unique paper code : 42167902

Name of the Paper : Cell and Molecular Biology

Name of the Course : **B.Sc. (Prog.) Life Science**

Semester : V

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 **ANY FIVE** questions in all. Question **No. 1** is compulsory
3. All questions carry equal marks. Answer all parts of a question together.

Q1. (a) Expand **ANY FIVE** of the follow (5x1=5)

(i) SEM
(ii) TBP
(iii) SSB protein
(iv) ATP
(v) SER
(vi) Cp DNA

(b) Fill in the Blanks (**ANY FIVE**) (5x1=5)

(i) ..... is a used as a fixative in Electron Microscopy.

(ii) 70s ribosomes are found in ..... Cells.

(iii) ..... is a marker enzyme of mitochondria.

(iv) Diffusion refers to the spontaneous movement of molecules from their..... concentration to .....concentration.

(v) Highly condensed form of chromatin is present in .....phase of somatic cell division.

(vi) Mitotic spindle is made up of ..... protein.

(vii) ..... enzyme is used to join DNA strands during replication.

(c) Match the followings: (5x1=5)

(i)	J. D. Robertson	Confocal Microscope
(ii)	Benda	Mitosis
(iii)	Marvin Minsky	Unit membrane model
(iv)	Walter Flemming	Nucleus
(v)	Robert Brown	Mitochondria

Q2. Write short notes on **ANY FIVE** of the following: (5x3=15)

(i) X-ray diffraction
(ii) Freeze fracturing
(iii) Function of Mitochondria
(iv) Binary Fission
(v) Okazaki fragments
(vi) Ribosomes
(viii) tRNA

Q3. Draw neatly labeled diagram of **ANY THREE** of the following: (3x5= 15)

(i) Ultrastructure of Mitochondria
(ii) Ray diagram of confocal microscope
(iii) Ultra structure of nucleus
(iv) Ray diagram of Fluorescence microscope
(v) Fluid Mosaic model of membrane

Q4. Differentiate between **ANY FIVE** of the following: (5x3=15)

(i) Active and Passive transport
(ii) Exocytosis and endocytosis
(iii) Euchromatin and Heterochromatin
(iv) Positive and negative gene regulation
(v) Inducer and repressor
(vi) Promotor and Terminator
(vii) DNA polymerase and RNA Polymerase

Q5. Answer **ANY THREE** (3x5=15)

(i) Briefly discuss the theta mode of replication in bacteria.
(ii) Explain semiautonomous nature of chloroplast.
(iii) Discuss about the Griffith transformation experiment.
(iv) Comment on the cell cycle and its phases with the help of diagram.
(vi) Draw and comment on Polytene chromosome

Q6. (i) Why are Lysosomes referred as Suicidal bags? Explain their structure and function in detail. (7)

(ii) How does the telomerase enzyme help in the replication of the 5' end of linear DNA in a eukaryotic cell? Discuss in brief. (5)

(iii) Differentiate among A, B and Z DNA. (3)

Q7. (i) Explain the structure and principle of SEM and list its application in biological studies. (8)

(ii) Describe the Lac operon in bacteria. (7)

4. (a) Justify ribosomes as ribozymes. (4)

   (b) Discuss briefly the post transcriptional modification of mRNA in eukaryotes. (8)

5. (a) Explain the functioning of *lac* operon. Supplement your answer with diagrammatic illustrations. (6)

   (b) Initiation of translation in eukaryotes. (6)

6. (a) Explain the classic experiment performed by Matthew Meselson and Franklin Stahl to prove that DNA Replication is semi-conservative. (6)

   (b) Explain the experiment conducted by Nirenberg and Khorana to decipher the Genetic Code. (6)

7. Write short notes on following (**any three**) : (4,4,4)

   (i) Role of enzymes in transcription

   (ii) Trombone model

   (iii) Mis-match repair mechanism

   (iv) DNA polymerase I

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5837 **I**

Unique Paper Code : 32231501

Name of the Paper : Molecular Biology

Name of the Course : **B.Sc. (Honours) Zoology, CBCS-LOCF**

Semester : V

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, including question No. **1** which is compulsory.

1. **All** parts of this question are compulsory :

   (i) Define : (5)

   (a) Replication fork

(b) Repressor

(c) Consensus sequence

(d) Polymerase switching

(e) Nonsense codon

(ii) Differentiate between the following : (8)

(a) Group I and Group II introns

(b) Cistron and operon

(c) DNA pol alpha and DNA pol epsilon

(d) Shine- Dalgarno and Kozak sequences

(iii) Expand the following : (5)

(a) MCM

(b) RISC

(c) DNA

(d) PCNA

(e) CTD

(iv) What is the contribution of the following scientists : (5)

(a) Rosalind Franklin

(b) Andrew Fire

(c) Marshal Nirenberg

(d) Arthur Kornberg

(e) Yonath & Ramakrishnan

(v) Draw the structure of (2×2)

(a) C-G Base pair

(b) 5' – 7 Methylguanosine Cap

2. Explain with suitable diagrams the mechanism of RNAi. (12)

3. (a) Explain the salient features of Watson Crick model of DNA double helix with suitable diagram. (8)

(b) In Eukaryotes (except cells displaying polyteny), Replication occurs only once during a cell Cycle. Justify the statement. (4)

(ii) Soil pollution and Soil degradation

(iii) Conventional and Non-conventional fuels

(iv) Afforestation and Restoration

4. (a) What is EIA? What are the various steps in the EIA process? Name some projects for which EIA is mandatory. (7.5)

(b) Climate Change is affecting the forest ecosystems in many ways. Discuss the consequences of changing climate on Tropical Rain Forests and Agro-ecosystems. (7.5)

5. (a) What is the present status of Solid Waste Management in India? Discuss some of the policy interventions that are being used for effective waste management. (7.5)

(b) What is the policy adopted for renewable energy certification? Discuss the potential of Hydrogen as a novel fuel. (7.5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1180 **I**

Unique Paper Code : 2163013006

Name of the Paper : Natural Resource Management

Name of the Course : **Botany**

Semester : V

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 **Q1,** which is compulsory.
3. **All** questions carry equal marks.
4. All parts of a question must be answered together.

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

(i) Ecological Footprint

(ii) Hotspots

(iii) Sustainable Development

(iv) Brundtland report

(v) Red Data List

(vi) Net Zero Emissions

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

(i) UNFCCC

(ii) UNEP

(iii) GIS

(iv) MoEFCC

(v) EIA

(vi) CPCB

(c) Match A and B (5×1=5)

A	B
(i) Wullar Lake	a. World Water Day
(ii) Chipko Andolan	b. Medha Patekar
(iii) Silent Valley	c. Ramsar Site
(iv) 22nd March	d. Ozone Day
(v) 16th September	e. Hydro Power Projects
(vi) Narmada Bachao Andolan	f. Sunder Lal Bahuguna

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

(i) Sacred Grooves

(ii) Project Tiger

(iii) Biomedical Waste Management Rules (India)

(iv) International Solar Alliance

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

(i) Convention on Biological Diversity and Basel Convention

(iii) Describe the structure of mature *Polygonum* type of embryo sac with the help of labeled diagram.

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5823 **I**

Unique Paper Code : 32161501

Name of the Paper : Reproductive Biology of Angiosperms

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

Semester / Mode : V (CBCS)

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** 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 well-labelled diagrams and write the botanical name wherever necessary.

P.T.O.

1. (a) State whether the following statements are true or false. (1×5=5)

(i) Tapetum forms the outermost anther wall layers that surround the sporogenous tissue.

(ii) Monosporic embryo sac is 7 celled and 8 nucleate structure.

(iii) Cheiropterophily is the pollination by insects.

(iv) S.G Nawaschin discovered the double fertilization.

(v) G.B. Amici has been given the credit of revealing the role of pollen in fertilization.

6. (a) Describe in detail any two methods to test Pollen viability. (5)

(b) Briefly explain any two types of Germline transformation methods. (5)

(c) Comment on Male Germ Unit and its structure with examples. (5)

7. Draw well labelled diagram of the following **(any two)** : (2×7.5=15)

(i) L.S. of anatropous, bitegmic, crassinucellate ovule showing *Polygonum* type of embryo sac.

(ii) T.S. young tetrasporangiate anther showing sporogenous tissue.

4. Briefly explain the following :

(a) Give the biological significance of seed dispersal phenomenon. (5)

(b) Describe briefly apomixis and its significance. (5)

(c) List six types of embryogeny and explain the embryo development in *Paeonia*. (5)

5. Answer the following :

(a) Write briefly on transformation of egg cell through pollen tube pathway method. (5)

(b) Role of tapetum in pollen development. (5)

(c) Describe any two methods to overcome self-incompatibility in plants. (5)

(b) Fill in the blanks : (1×5=5)

(i) Pollination that takes place with the help of beetles is called _____ .

(ii) The explusion of seed, brought about by the turgidity is called _____ .

(iii) Nutrient rich nucellar tissue that persists in mature seed is called _____ .

(iv) _____ demonstrated the possibility of raising large numbers of haploids from pollen grains of *Datura innoxia*.

(v) The megasporangium together with integuments is called _____ .

(c) Match the following : (1×5=5)

Column A	Column B
a. *Aristolochia elegans*	i. Pseudocopulation
b. *Quinchamalium chilense*	ii. Five types of microspore tetrads
c. *Plumbago zeylanica*	iii. Finger like projections in egg cell
d. *Ophrys speculum*	iv. Synergid and antipodal haustoria
e. *Fritillaria*	v. Bambacioni effect

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

(i) Role of synergids in fertilization

(ii) Importance of polyembryony

(iii) Helobial endosperm

(iv) Nemec phenomenon

(v) Obturator

(vi) Pollen Wall

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

(i) Egg cell and Synergids

(ii) 2-celled and 3-celled pollens

(iii) Gametophytic and Sporophytic self-incompatibility

(iv) Hyphydrophily and ephydrophily