MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END THEORY EXAMINATION

B.Sc.(Hons.) Agriculture / B.Sc.(Hons.) ABM / B.Tech. (Food Tech.)

Semester	: 1 (New)	Term	: First	Academic Year	: 2022-23
Course No.	: BIO 111	Title	: Introductory Biology		
Credits	: 2 (1+1)				
Day & Date	: Friday, 24.03.2023	Time	: 10:00 to 12:00 hrs.	Total Marks	: 40

Note :
1. Solve ANY EIGHT questions from SECTION 'A'.
2. All questions from SECTION 'B' are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 Define Cell. Enlist the different cell organelles and explain mitochondria with the help of neat labelled diagram.

Q.2 Define Biological classification. Enlist objectives of classification and describe types of biological classification.

Q.3 State Mendel's Laws of inheritance and enlist the characters studied by Mendel while working on inheritance in *Pisum sativum*.

Q.4 Define Root. Give its modification and functions.

Q.5 What is Binomial Nomenclature? Explain the main rules of binomial nomenclature with suitable examples.

Q.6 Define Mitosis. Describe different stages of mitosis with neat diagram.

Q.7 Define Flower. Explain the structure of flower with suitable diagram.

Q.8 Define Seed germination. Explain the factors affecting on seed germination.

Q.9 Enlist theories of origin of life and explain Oparin-Haldane theory.

Q.10 Describe the family Fabaceae.

SECTION 'B'

Q.11 Fill in the blanks:

1) _____ is known as a reductional cell division.

2) When the petals of the corolla and the sepals of the calyx cannot be differentiated, the part of the flower is termed as _____.

3) Five kingdom system of classification was first given by Scientist _____.

4) Banana plant shows _____ shape of leaf lamina.

Q.12 Define the following terms:

1) Eugenics 2) Systematics 3) Fruit 4) Division

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Model Answer Paper

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SECTION "A"

Q. 1 Define cell? Enlist the different cell organelles and explain mitochondria with the help of neat labeled diagram.

Definition- Cell is the basic structural and functional unit of all living organisms. 1

Cell organelles- 1

1. Endoplasmic reticulum
2. Golgi apparatus
3. Lysosomes
4. Vacuole
5. Nucleus
6. Mitochondria
7. Plastids
8. Cell wall

Mitochondria 1

It is known as a power house of a cell. It has a double membrane structure – The **Outer** membrane and **Inner** membrane. The inner membrane is folded to form a structure known as **Cristae**. It is a site for ATP synthesis. The outer membrane and inner membrane is separated by inter-membrane space. The inner compartment is known as **Matrix**. DNA and ribosomes are present in the matrix of the mitochondria.

1

Q. 2 Define Biological Classification. Enlist objectives of classification and describe types of biological classification.

Ans. Definition- Biological Classification is the scientific study of arranging organisms into group and subgroup on the basis of their similarities and dissimilarities and placing the group in a hierarchy of categories. 1

***Objectives of* Classification** 1

1. To identify and describe all the possible types of species.
2. To arrange the species in various categories on the basis of their similarities and dissimilarities.
3. To evolve a truly natural or phylogenetic system which should indicate origin and evolution of the species?
4. Helping in easy identification of organisms.

2

Types of Biological Classification(Along with description)

1. Artificial System of Classification:

It is a system of classification which uses one or two morphological character for grouping of organisms. Some artificial system have used habit and habitat for this purpose. Aristotle (c 350 BC) divided animals into two categories, enaima (with red blood) and anaima (without red blood). Aristotle also classified animals on the basis of their habitat- aquatic (e.g, fish and whale), terrestrial (e.g, reptiles, cattle) and aerial (e.g. birds, bat). Pliny the Elder (23-79 A.D.) used artificial system of classification for both plants and animals dividing them into land, air and water. Pliny distinguished animals into flight band non-flight ones. Flight animals included bats, birds and insects.

2. Natural System of Classification:

It is a system of classification which takes into consideration comparable study of a number of characters so as to bring out nature similarities and dissimilarities and hence nature relationship among the organisms. The system employs those characters which are relatively constant. They include morphological characters, anatomical characters, cytological characters, physiology, ontogeny or development, reproduction, cytochemistry and biochemistry, experimental taxonomy, etc. the characteristics are helpful in bringing out maximum number of similarities in a group and comparable differences with other group of organisms. **For example**, mammals are characterised by the presence of mammae, birds possess wings, feathers, pneumatic bones, ovipary, 4- chambered. They are coldblooded.

3. Phylogenetic System of Classification:

Classification based on evolutionary relationship of organisms is called phylogenetic system of classification. It is based on the evolutionary concept from Darwin's book- on the origin of species by means of natural selection. The preservation of favoured races in the struggle for life (1859). It reflects the true relationships among the organisms. First phylogenetic system was proposed by Engler and Pranti (1887-99). Zoologists believe that since similarity in structure represents close evolutionary relationship, their natural classification represents evolutionary and phylogenetic classification.

Q. 3 State Mendel's Laws of inheritance and enlists the characters studied by Mendel while working on inheritance in *Pisum sativum*.

Ans. 1. **Law of Segregation**- According to the law of segregation, for any particular trait, the pair of alleles of each parent separate and only one allele passes from each parent on to an offspring. Which allele in a parent's pair of alleles is inherited is a matter of chance. We now know that this segregation of alleles occurs during the process of sex cell formation (i.e., meiosis). 2

2. **Law of independent assortment**- According to the **law of independent assortment**, different pairs of alleles are passed to offspring independently of each other. The result is that new combinations of genes present in neither parent are possible.

1	flower color is purple or white	5	seed color is yellow or green
2	flower position is axial or terminal	6	pod shape is inflated or constricted
3	stem length is long or short	7	pod color is yellow or green
4	seed shape is round or wrinkled		

2

Q. 4 **Define root. Give its modification and functions.**

Ans **Definition**- Root is the descending, non-green, underground part lacking nodes, internodes, leaves and buds. 1

Modifications of the Root:- 3

- Fusiform root is a modified form of tap root. The root is swollen from the middle and tapers at both the ends. For Example: Radish
- Napiform roots are also a modified tap root. They have swollen base and then it tapers abruptly. For Example: Turnip
- Prop roots are roots which are modified for aerial support. For Example: Corn
- Stilt roots are modified roots for support. For Example: Maize
- Pneumatophores are roots modified for respiration. They grow in swampy area and grow vertically upwards. For Example: Rhizophora

Functions of the Root:-

- To absorb water and minerals from the soil.
- To provide proper anchorage to the plants.
- To store reserve food materials
- Synthesis of plant growth regulators

Q. 5 **What is Binomial Nomenclature? Explain the main rules of botanical nomenclature with suitable examples.**

Ans. **Definition**- The investigative name has two segments Generic Name and the Particular Sobriquet. This arrangement of naming is called Binomial Nomenclature. 1

Main rules of binomial nomenclature with suitable examples. 3

1. According to binomial system name of any species consists of two names

(i) Generic name - Name of genus

(ii) Specific name - Trival name

Example: Specific Name: Mango: Generic Name: *Mangiferaindica*

2. In plant nomenclature (ICBN), tautonyms are not valid i.e. generic name and specific name should not be same in plants. Example: *Mangiferamangifera*

But tautonyms are valid for animal nomenclature (ICZN-International Code of Zoological Nomenclature)Example:*Najanaja*(Indian cobra), *Rattusrattus* (Rat)

3. Length of generic mime or specific name should not be less than 3 letters and not more than 12 letters.Example: *Mangiferaindica*

4. First letter of generic name should be in capital letter and first letter of specific name should be in small letter. Example: *Mangiferaindica*

But if specific name is based on the name of some person, its first letter should be in capital letter ego IsoetesPantii

5. When written with free hand or typed, then generic name and specific name should be separately underlined. But during printing, name should be italized.

6. Name of scientist (who proposed nomenclature) should be written in short after the specific name Example: *Mangifera indica* Lin.

7. Name of scientist should be neither underlined nor written in italics, but written in roman, letters (simple alphabets)

8. If any scientist has proposed wrong name then his name should be written in bracket and the scientist who corrected the name should be written after the bracket.Example: *Tsugacanadensis*(Lin.) Salisbury

Note: Linnaeus named this plant as *Pinus canadensis*

9. Scientific names should be derived from Latin or Greek languages because they are dead languages.

10. Type specimen (Herbarium Sheet) of newly discovered plant should be placed in herbarium (Dry garden).

11. Standard size of herbarium sheet is 11.5 × 16.5 inches

Q. 6 Define Mitosis. Describe different stages of mitosis with neat diagram.

Ans. **Definition:** It is also called indirect cell division or somatic cell division or equational division. In this, mature somatic cell divides in such a way that chromosomes number is kept constant in daughter cells equal to those in parent cell, so the daughter cells are quantitatively as well as qualitatively similar to the parental cell. So it is called equational division. 1

(Description of four phases and neat diagram is required.)

3

Mitosis is completed in two steps.

1. Karyokinesis: (Gk. karyon = nucleus; kinesis = movement) Division of nucleus. Term given by Schneider (1887).
2. Cytokinesis: (Gk. kitos = cell; kinesis = movement) Division of cytoplasm. Term given by Whitemann (1887).

Karyokinesis

It comprises four phases *i.e.* Prophase, Metaphase, Anaphase, Telophase.

Prophase

It is largest phase of karyokinesis.

- ✓ Chromatin fibres thicken and shorter to form chromosomes which may overlap each other and appears like a ball of wool. i.e. Spireme stage.
- ✓ Each chromosome divides longitudinally into 2 chromatids which remain attached to centromere.
- ✓ Nuclear membrane starts disintegrating except in dinoflagellates.
- ✓ Nucleolus starts disintegrating.
- ✓ Cells become viscous, refractive and oval in outline.
- ✓ Spindle formation begins.
- ✓ Cell cytoskeleton, Golgi complex, ER, etc. disappear.
- ✓ In animal cells, centrioles move towards opposite sides.
- ✓ Lampbrush chromosomes can be studied well.
- ✓ Small globular structure (beaded) on the chromosome is called chromomeres.

Metaphase

- Chromosomes become maximally distinct i.e. size can be measured.
- A colourless, fibrous, bipolar spindle appears.
- Spindle is formed from centriole (in animal cells) or MTOC (microtubule organising centre) in plant cells successively called astral and anastral spindle.
- Spindle has 3 types of fibres.
  - ✓ Continuous fibre (run from pole to pole).
  - ✓ Discontinuous fibre (run between poles to centromeres).
  - ✓ Interzonal fibre (run between 2 centromere).
- Spindle fibre are made up of 97% tubulin protein and 3% RNA.
- Chromosomes move towards equatorial plane of spindles called congression and become arranged with their arms directed towards pole and centromere towards equator.
- Spindle fibres attach to kinetochores.
- Metaphase is the best stage for studying chromosome morphology.

Anaphase

- ✓ Centromere splits from the middle and two chromatids gets separated.
- ✓ Both the chromatids move towards opposite poles due to repulsive force called anaphasic movement.

- ✓ Anaphase movement is brought about by the repolymerisation of continuous fibres and depolymerisation of chromosomal fibres.
- ✓ Different shape of chromosomes become evident during chromosome movement viz. metacentric acrocentric etc.
- ✓ Chromosomes takes V, J, I or L shapes.
- ✓ The centromere faces towards equator.
- ✓ The chromatids are moved towards the pole at a speed of 1 mm/minute. About 30 ATP molecules are used to move one chromosome from equator to pole.

Telophase

- ✓ Chromosomes reached on poles by the spindle fibers and form two groups.
- ✓ Chromosomes begin to uncoil and form chromatin net.
- ✓ The nuclear membrane and nucleolus reappear.
- ✓ Two daughter nuclei are formed.
- ✓ Golgi complex and ER etc., reform.

Cytokinesis:

It involves division of cytoplasm in animal cells, the cell membrane develops a constitution which deepens centripetally and is called cell furrow method. In plant cells, cytokinesis occurs by cell plate formation.

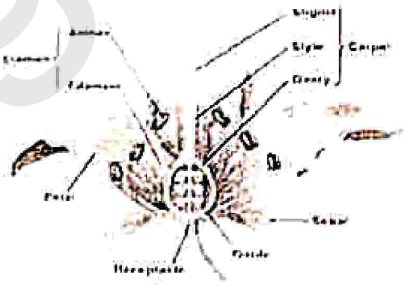
Q. 7 Define Flower. Explain the structure of flower with suitable diagram.

Ans. **Definition-** The modified shoot is known as Flower. 1

Structure of the Flower:- 2

Each flower has four whorls- sepals, petals, stamens and the carpels. Sepals are a green leafy structure that covers the flower bud. Petals are bright colored to attract insects for pollination. Gynoecium is female reproductive structures whereas Androecium is the male reproductive structure. Gynoecium is composed of carpels. Carpels comprises of three structures ovary, style and stigma. Ovary comprises of ovules that forms the seed, whereas stigma is the place of landing of pollen at the time of pollination. Ovary finally forms the fruit. The male part of the flower is known as Androecium. Androecium is composed of stamens. Stamen is composed of anther and the filament. Anthers contain the pollen grains, the male gamete.

Diagram of flower:



1

Q. 8 Define Seed germination. Explain the factors affecting on seed germination.

Ans. Definition- Seed Germination is the process of reactivation of metabolic machinery of the seed resulting in the emergence of radicle and plumule. 1

Factors affecting seed germination 3

Germination is depends on availability of water, health of the seeds, time, temperature and heat, presence of oxygen, and exposures to light play an important role in the germination process.

- ✓ Temperature: Extremely low or cold temperature is not favourable for seed germination. They prefer higher temperatures. The germination rate of seed is directly proportional to the rise in temperature.
- ✓ Moisture or water: Dry seeds do not germinate. Water is an essential factor to trigger off the process of seed germination.
- ✓ Soil: During growth, seeds require mineral elements for further growth which is obtained from the soil.
- ✓ Light: For seed germination light is not essential in the early stages of germination but plays a main role in the later stages of the life cycle of plants.
- ✓ Viability of the seeds: After the seeds are formed, they remain viable up to certain period which may vary from plant to plant or seed to seed. Many sees die or incapable of supporting growth after a certain period of time.
- ✓ Dormancy period: Many seeds do not germinate abruptly after they are produced. Certain seeds undergoes a resting time through which they stay dormant and germinate when conditions are favourable. Presence of growth inhibitors like abscisic acid induces dormancy in seeds.
- ✓ Thinness or thickness of seed coat: Different seeds have varying degrees of thickness to enable the seeds to remain feasible. Seeds with a thin seed coat tend to germinate faster than those with thicker seed coats.

Q. 9 Enlist theories of origin of life and explain Oparin-Haldane theory.

Ans.

Theories of origin of life: 1

Various theories have been put forward to explain the phenomenon of origin of life. A few of them were only speculations while others were based on scientific grounds. These theories are

- ✓ Theory of special creation.
- ✓ Theory of spontaneous generation or Abiogenesis.
- ✓ Biogenesis
- ✓ Cosmozoic theory
- ✓ Theory of sudden creation from inorganic material.
- ✓ Naturalistic theory

Description of Oparin-Haldane theory of chemical origin of life 3

- ✓ Oparin (1924) proposed that "life could have originated from non-living organic molecules."
- ✓ He believed in Biochemical origin of life. Haldane (1929) also stated

(v) Evidences from Embryology
(vi) Evidences from Palaeontology
(vii) Evidences from geographic distribution
(viii) Evidences from Genetics

Q.10 Describe the family Fabaceae. 4

Ans. Description of Fabaceae:

Family Fabaceae is large family including plants which are economically important. The family Fabaceae also was known as Leguminosae or Papilionaceae since it is the pea or legume family.

Root: Dicotyledons with taproot with root nodules.

Stem: Erect or climber; Fabaceae include shrubs, herbs, trees and majorly climbers.

Leaves: Petiolate, pinnately compound or simple; pulvinus leaf base, stipulate; reticulate venation.

Inflorescence: Racemose or solitory axillary.

Flower: Bracteate or ebracteate rarely bracteolate (e.g., Arachis), pedicellate or sessile, complete, irregular, zygomorphic, perigynous or occasionally hypogynous, pentamerous.

Calyx: Sepals 5, gamosepalous, usually companulate, lobe unequal, rarely tubular (e.g, Cyamopsis), odd sepal anterior, may be persistent inferior.

Corolla: Petals 5, polypetalous, papilionaceous, descending imbricate aestivation, one posterior long standered, two lateral short wings, and two anterior petals jointed to each other forming keel.

Androecium: Stamens 10, usually diadelphous (9+1 in Lathyrus, 5+5 in Aeschynomene) or monadelphous (9 in Dalbergia, 10 in Arachis and Erythrina indica), rarely free (e.g., Sophora), nectar gland often present on the inner bases of filaments, anther lobes bilocular, dorsifixed, introse.

Gynoecium: Monocarpellary, ovary superior, unilocular with marginal placentation ovary covered by staminal tube, style bent, stigma simple or capitate.

Fruit: Legume or lomentum.

Floral formula: % $K_{(5)}\ C_{1+(2)+2}\ A_{(9)+1}\ \underline{G}_1$

SECTION " B "

Q. 11 Fill in the blank.

1 Meiosis is known as a reductional cell division.

2 When the petals of the corolla and the sepals of the calyx cannot be differentiated, the part of the flower is termed as Perianth.

3 Five kingdom system of classification was first given by scientist Whittaker.

4 Banana plant shows oblong shape of leaf lamina.

Q. 12 **Define the following terms.**

1 **Eugenics:** Eugenics is defined as a branch of botany in which application of principles of genetics for improving the human being.

2 **Systematics:** Systematics is defined as a scientific study of similarities and differences among the different kinds of organisms and plants which include their identification, nomenclature and classification".

3 **Fruit:** Fruit is the mature ovary or ovaries of one or more flowers.

4 **Division:** In plant kingdom, a group of closely related classes is known as a division.

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