

**R4621**

**Sub. Code**

**25IMB2C1**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Second Semester**

**Integrated Marine Biology**

**ANIMAL DIVERSITY**

**(CBCS – 2025 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The scientific naming of organisms using two names is known as (CO1, K2)
  - (a) Classification
  - (b) Taxonomy
  - (c) Binomial nomenclature
  - (d) Systematics
2. Which taxonomic category includes closely related species? (CO1, K1)
  - (a) Family
  - (b) Order
  - (c) Genus
  - (d) Phylum
3. Which phylum is characterized by the presence of cnidocytes? (CO2, K1)
  - (a) Porifera
  - (b) Cnidaria
  - (c) Ctenophora
  - (d) Annelida

4. The water vascular system is a characteristic feature of (CO2, K1)
- (a) Mollusca (b) Arthropoda  
(c) Echinodermata (d) Annelida
5. Tornaria larva is associated with \_\_\_\_\_ phylum. (CO3, K2)
- (a) Urochordata (b) Cephalochordata  
(c) Hemichordata (d) Echinodermata
6. The notochord is best developed in (CO3, K2)
- (a) Hemichordata (b) Urochordata  
(c) Cephalochordata (d) Vertebrata
7. Paedomorphosis is commonly observed in which animals? (CO4, K1)
- (a) Reptiles (b) Amphibians  
(c) Birds (d) Mammals
8. Accessory respiratory organs are commonly found in (CO4, K2)
- (a) Amphibia (b) Pisces  
(c) Reptilia (d) Aves
9. Dentition refers to (CO4, K1)
- (a) Arrangement of muscles  
(b) Structure of jaw  
(c) Type and arrangement of teeth  
(d) Development of skull
10. Which of the following organ responsible for olfaction in vertebrates? (CO5, K1)
- (a) Eye (b) Ear  
(c) Nose (d) Tongue

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Examine the role of symmetry and germ layers in the evolution of invertebrate phyla. (CO1, K3)

Or

- (b) Illustrate the inter-relationship among Porifera, Cnidaria and Platyhelminthes. (CO1, K3)

12. (a) Infer the adaptive significance of radial symmetry and water vascular system in echinoderms. (CO2, K4)

Or

- (b) Compare the reproductive biology and larval forms of Chaetognatha and Brachiopoda. (CO2, K4)

13. (a) Justify the inclusion of Hemichordata as a connecting link between non-chordates and chordates. (CO3, K5)

Or

- (b) Evaluate the reproductive strategies and modes of fertilization in Urochordata. (CO3, K5)

14. (a) Classify phylum Chordata up to major subphyla and classes. (CO4, K4)

Or

- (b) Outline the classification of Aves and Mammalia. (CO4, K4)

15. (a) Evaluate the dentition in mammals. (CO4, K5)

Or

- (b) Compare the circulatory system of fish and birds. (CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Outline the major evolutionary trends observed among invertebrates from lower to higher forms.

(CO1, K4)

Or

- (b) Classify the major invertebrate phyla based on levels of organization and body plan.

(CO1, K4)

17. (a) Evaluate the classification of marine invertebrates.

(CO2, K5)

Or

- (b) Compare the characteristic features of phyla Chaetognatha, Brachiopoda, Phoronida and Pogonophora.

(CO2, K5)

18. (a) Compose an essay on theories proposed for the origin and evolution of Hemichordata.

(CO3, K6)

Or

- (b) Formulate the phylogenetic importance of Urochordate larval forms in understanding chordate evolution.

(CO3, K6)

19. (a) Evaluate the structure, function and adaptive significance of accessory respiratory organs in fishes.

(CO4, K5)

Or

- (b) Assess the adaptive radiation in mammals with suitable examples.

(CO4, K5)

20. (a) Analyze the derivatives of integument in birds and mammals and their functions.

(CO5, K4)

Or

- (b) Illustrate the olfactory and auditory receptors in vertebrates.

(CO5, K4)

**R4622**

**Sub. Code**

**25IMB2A1**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Second Semester**

**Integrated Marine Biology**

**Allied – GENERAL CHEMISTRY – II**

**(CBCS – 2025 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the questions by choosing the correct option.

1. The maximum number of electrons in a p-orbital is  
(CO1, K1)
  - (a) 1
  - (b) 2
  - (c) 6
  - (d) 10
2. The shape of  $\text{BF}_3$  molecule according to VSEPR theory is  
(CO1, K2)
  - (a) Tetrahedral
  - (b) Trigonal planar
  - (c) Linear
  - (d) Octahedral

3. The Root mean square (RMS) of a gas is proportional to (CO2, K2)
- (a)  $\sqrt{T}$
  - (b)  $1/\sqrt{T}$
  - (c)  $T$
  - (d)  $1/T$
4. Deviation of real gases is maximum at (CO2, K2)
- (a) Low pressure and high temperature
  - (b) High pressure and low temperature
  - (c) Low pressure and low temperature
  - (d) High temperature only
5. The binding energy of a nucleus is due to (CO3, K1)
- (a) Electrostatic force
  - (b) Gravitational force
  - (c) Nuclear force
  - (d) Magnetic force
6. The unit of radioactivity element measured is (CO3, K1)
- (a) Joule
  - (b) Curie
  - (c) Pascal
  - (d) Newton

7. Magnesium ion is present at the centre of the bioinorganic molecule (CO4, K1)
- (a) Haemoglobin
  - (b) Chlorophyll
  - (c) Vitamin B<sub>12</sub>
  - (d) Insulin
8. Mercury poisoning primarily affects one of the following systems (CO4, K2)
- (a) Digestive system
  - (b) Respiratory system
  - (c) Nervous system
  - (d) Skeletal system
9. IF<sub>7</sub> is the type example of an interhalogen (CO5, K2)
- (a) XY type interhalogen
  - (b) XY<sub>3</sub> type interhalogen
  - (c) XY<sub>5</sub> type interhalogen
  - (d) XY<sub>7</sub> type interhalogen
10. Ozone acts as a strong agent in the chemical reaction (CO5, K1)
- (a) Reducing agent
  - (b) Oxidizing agent
  - (c) Catalyst
  - (d) Buffer

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain hybridization involving  $sp$ ,  $sp^2$ , and  $sp^3$  with suitable examples. (CO1, K3)

Or

- (b) Draw the MO diagram of the  $O_2$  molecule and calculate its bond order. (CO1, K4)

12. (a) Discuss to derive the Van der Waals equation for real gases. (CO2, K4)

Or

- (b) Discuss the deviation of real gases from ideal behaviour and explain the causes. (CO2, K3)

13. (a) Explain nuclear fission with a suitable example and mention its applications. (CO3, K3)

Or

- (b) Derive the relation between the half-life period and the decay constant of the isotopes. (CO3, K4)

14. (a) Describe the role of iron in oxygen transport by the haemoglobin molecule. (CO4, K3)

Or

- (b) Explain the role of alkaline earth metal ions in biological systems. (CO4, K4)

15. (a) Discuss the general trends in the properties of halogens. (CO5, K3)

Or

- (b) Classify carbides into ionic, covalent, and interstitial carbides with examples. (CO5, K4)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain VSEPR theory and predict the shapes of  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ , and  $\text{BF}_3$ . (CO1, K4)

Or

- (b) Describe Molecular Orbital Theory and construct MO diagrams for  $\text{N}_2$  and  $\text{F}_2$ . (CO1, K4)

17. (a) Derive the expression for pressure of a gas based on kinetic theory and deduce gas laws. (CO2, K4)

Or

- (b) Discuss surface tension and viscosity of liquids and explain Trouton's rule with significance. (CO2, K3)

18. (a) Explain nuclear stability in terms of binding energy and mass defect. (CO3, K4)

Or

- (b) Describe applications of radioactivity in medicine, agriculture, industry and carbon dating. (CO3, K3)

19. (a) Explain photosynthesis and the structure and function of chlorophyll. (CO4, K3)

Or

- (b) Discuss cadmium and mercury poisoning and their toxic effects. (CO4, K4)

20. (a) Explain interhalogen compounds such as  $XY_3$ ,  $XY_5$ ,  $XY_7$  types with examples. (CO5, K4)

Or

- (b) Describe the manufacturing, oxidizing, and reducing properties and uses of ozone. (CO5, K3)
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**R4996**

**Sub. Code**

**548401**

**M.Sc. DEGREE EXAMINATION, APRIL 2026**

**Fourth Semester**

**Integrated Marine Biology**

**ECOLOGY AND ZOOGEOGRAPHY**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the objective type questions  
by choosing the correct option.

1. Which ecological factor primarily determines the vertical zonation of marine organisms in the ocean? (CO1, K1)
  - (a) Salinity
  - (b) Pressure
  - (c) Light
  - (d) Temperature
2. Bipolar distribution refers to the occurrence of species in. (CO1, K2)
  - (a) Tropical oceans only
  - (b) Equatorial regions
  - (c) Both Arctic and Antarctic regions
  - (d) Deep-sea trenches

3. The linear transfer of energy from producers to top consumers in an ecosystem is known as: (CO2, K1)
- (a) Food web
  - (b) Ecological pyramid
  - (c) Food chain
  - (d) Nutrient cycle
4. Recycling of nutrients in marine ecosystems is mainly facilitated by (CO2, K2)
- (a) Primary producers
  - (b) Grazers
  - (c) Decomposers and microbes
  - (d) Top predators
5. Which of the following is considered a group attribute of a population? (CO3, K1)
- (a) Metabolism
  - (b) Intelligence
  - (c) Birth rate
  - (d) Homeostasis
6. A population showing a pyramid-shaped age structure indicates (CO3, K2)
- (a) Declining population
  - (b) Stable population
  - (c) Rapidly growing population
  - (d) Extinct population

7. Which of the following best defines community stratification? (CO4, K1)
- (a) Horizontal distribution of species
  - (b) Vertical layering of organisms in a community
  - (c) Seasonal migration of species
  - (d) Random distribution of populations.
8. The ecological niche of a species primarily refers to its: (CO4, K2)
- (a) Physical habitat only
  - (b) Feeding habit alone
  - (c) Functional role and position in an ecosystem
  - (d) Population size
9. What is marine biodiversity? (CO4, K1)
- (a) Variety of freshwater organisms only
  - (b) Diversity of organisms in marine ecosystems at genetic, species, and ecosystem levels
  - (c) Distribution of minerals in oceans
  - (d) Ocean circulation patterns
10. What is meant by physical alteration of marine habitats? (CO5, K1)
- (a) Seasonal migration of marine species
  - (b) Natural oceanic currents
  - (c) Human-induced modification of marine habitats such as dredging and coastal construction
  - (d) Genetic variation in marine species

**Part B**

(5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Examine how light availability influences the vertical zonation of organisms in the pelagic environment. (CO1, K3)

Or

- (b) Compare planktonic and nektonic adaptations with reference to locomotion, buoyancy and feeding strategies. (CO1, K5)

12. (a) Outline the concept of energy flow to explain why higher trophic levels support fewer organisms in marine ecosystems. (CO2, K4)

Or

- (b) Analyze the differences between food chain and food web, highlighting their ecological significance in marine ecosystems. (CO2, K4)

13. (a) Evaluate the significance of population density variation and explain the different methods used to measure population density. (CO3, K5)

Or

- (b) Choose the concept of carrying capacity and discuss how density-dependent factors regulate population growth (CO3, K5)

14. (a) Outline the structural organization of a biological community with reference to species composition and stratification. (CO4, K4)

Or

- (b) Differentiate and justify the ecological significance of niche concept in regulating species coexistence within a community. (CO4, K5)

15. (a) Assess the importance of marine biodiversity. (CO4, K5)

Or

- (b) Choose the impacts of pollution on marine biodiversity. (CO5, K5)

**Part C** (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Analyze the major ecological factors and discuss their combined influence on the distribution of marine organisms. (CO1, K4)

Or

- (b) Assess the role of coral reefs as highly productive marine ecosystems and evaluate the threats affecting their survival. (CO1, K5)

17. (a) Critically evaluate ecosystem services provided by marine ecosystems, with suitable examples. (CO2, K5)

Or

- (b) Develop an account of Ecological Pyramids (CO2, K6)

18. (a) Compose a brief essay on prey–predator relationship as a regulatory mechanism of population size. (CO3, K6)

Or

- (b) Compare and contrast intraspecific and interspecific competition. (CO3, K5)

19. (a) Explain and analyze the process of ecological succession (CO4, K4)

Or

- (b) Describe and assess the adaptations of fouling and boring communities in the marine environment. (CO4, K5)

20. (a) Illustrate the major threats to marine biodiversity. (CO5, K4)

Or

- (b) Assess how physical alteration of marine habitats affects marine biodiversity. (CO5, K5)

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**R4997**

**Sub. Code**

**548402**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Fourth Semester**

**Integrated Marine Biology**

**VERTEBRATES**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Which of the following is considered the earliest chordate feature to appear during evolution? (CO1, K2)
  - (a) Vertebral column
  - (b) Notochord
  - (c) Paired appendages
  - (d) Jaw apparatus
2. The first vertebrates are believed to have appeared during which geological period. (CO1, K1)
  - (a) Ordovician
  - (b) Cambrian
  - (c) Devonian
  - (d) Permian
3. The endoskeleton of bony fishes is primarily composed of: (CO2, K1)
  - (a) Cartilage
  - (b) Bone
  - (c) Chondrin
  - (d) Fibrous tissue

4. Dipnoi are considered connecting links because they possess; (CO2, K2)
- (a) Placoid scales and spiral valve
  - (b) Both gills and lungs
  - (c) Cartilaginous endoskeleton
  - (d) External fertilization only
5. The earliest reptile-like amphibian showing a transition from amphibians to reptiles is; (CO3, K1)
- (a) Ichthyosaurus      (b) Seymouria
  - (c) Archaeopteryx      (d) Dimetrodon
6. Which adaptation primarily enables marine birds to excrete excess salt? (CO3, K2)
- (a) Pneumatic bones
  - (b) Counter-shaded plumage
  - (c) Salt glands
  - (d) Keeled sternum
7. Which of the following mammals lays eggs and possesses a cloaca? (CO4, K1)
- (a) Kangaroo      (b) Dolphin
  - (c) Platypus      (d) Bat

8. Marsupials differ from placental mammals mainly in:  
(CO4, K2)
- (a) Mode of fertilization
  - (b) Nature of placenta
  - (c) Presence of mammary glands
  - (d) Endothermy
9. Which type of cleavage is characteristically observed in most teleost fishes?  
(CO4, K1)
- (a) Holoblastic equal cleavage
  - (b) Holoblastic unequal cleavage
  - (c) Meroblastic discoidal cleavage
  - (d) Superficial cleavage
10. Axis formation in fish embryos is primarily regulated by which embryonic structure?  
(CO5, K2)
- (a) Blastocoel                      (b) Yolk syncytial layer
  - (c) Embryonic shield      (d) Neural tube

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Illustrate how the geological time scale helps in understanding the progressive evolution of vertebrates.  
(CO1, K3)

Or

- (b) Examine the Urochordate theory of chordate origin.  
(CO1, K3)

12. (a) Analyze the characteristic features of ancestral vertebrates with reference to jawless fishes. (CO2, K4)

Or

- (b) Compare and analyze the anatomical peculiarities of Urodela and Apoda. (CO2, K4)

13. (a) Evaluate the adaptive radiation of contemporary reptiles. (CO3, K5)

Or

- (b) Choose the evolutionary importance of mammal-like reptiles. (CO3, K5)

14. (a) Compare monotremes, marsupials, and placental mammals with respect to evolutionary significance. (CO4, K5)

Or

- (b) Analyze the respiratory adaptations of aquatic mammals. (CO4, K4)

15. (a) Analyze the pattern of cleavage in fish eggs. (CO4, K4)

Or

- (b) Design a flowchart showing the sequential stages of neurulation in teleost fishes. (CO5, K6)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Assess the comparative importance of Urochordata, Cephalochordata, and hemichordata. (CO1, K5)

Or

- (b) Evaluate the Hemichordate theory and Echinoderm theory regarding the origin of chordates. (CO1, K5)

17. (a) Critically evaluate the evolution and adaptive radiation of bony fishes with suitable examples.

(CO2, K5)

Or

- (b) Develop a comprehensive account on the origin, evolution, and geographical distribution of Amphibia. (CO2, K6)

18. (a) Analyze the origin of reptiles from amphibian ancestors. (CO3, K4)

Or

- (b) Critically assess the adaptations of marine birds. (CO3, K5)

19. (a) Outline the general characters of mammals. (CO4, K4)

Or

- (b) Critically evaluate the evolution and classification of Cetacea and Sirenia (CO4, K5)

20. (a) With suitable diagrams, explain germ layer formation during fish development. (CO5, K4)

Or

- (b) Formulate the mechanisms of axis formation in fish development. (CO5, K6)
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**R4998**

**Sub. Code**

**2MB4A1**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Fourth Semester**

**Integrated Marine Biology**

**Allied : BOTANY**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Who is the father of plant taxonomy? (CO1, K1)
  - (a) Aristotle
  - (b) Darwin
  - (c) Carolus Linnaeus
  - (d) Hooker
  
2. The term “Taxonomy” was coined by (CO1,K1)
  - (a) Bentham
  - (b) A.P. de Candolle
  - (c) John Ray
  - (d) Hutchinson
  
3. Annona belongs to which family? (CO2, K2)
  - (a) Solanaceae
  - (b) Annonaceae
  - (c) Euphorbiaceae
  - (d) Fabaceae
  
4. Which family has epigynous flowers? (CO2, K2)
  - (a) Malvaceae
  - (b) Fabaceae
  - (c) Euphorbiaceae
  - (d) Poaceae

5. Sandalwood oil is obtained from (CO3, K1)  
(a) Dalbergia sissoo (b) Tectona grandis  
(c) Santalum album (d) Azadirachta indica
6. Cotton is obtained from which plant part? (CO3, K1)  
(a) Bark (b) Fruit  
(c) Leaf (d) Seed hairs
7. Embryo sac develops from (CO4, K1)  
(a) Microspore (b) Ovule  
(c) Megaspore (d) Endosperm
8. How many nuclei are found in a mature embryo sac? (CO4, K1)  
(a) Four (b) Six  
(c) Eight (d) Ten
9. Double fertilization is found in (CO5, K1)  
(a) Pteridophytes (b) Gymnosperms  
(c) Bryophytes (d) Angiosperms
10. Endosperm is formed by (CO5, K1)  
(a) Fertilization of ovule  
(b) Triple fusion  
(c) Mitosis of zygote  
(d) Development of embryo

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain the aim and significance of taxonomy in botany. (CO1, K4)
- Or
- (b) Describe the herbarium techniques used in plant taxonomy. (CO1, K2)

12. (a) Write a comparative account of the Annonaceae and Rutaceae families. (CO2, K3)

Or

- (b) Apply your understanding to construct a floral diagram for Euphorbiaceae. (CO2, K3)

13. (a) Illustrate the economic importance of any two fibre-yielding plants. (CO3, K3)

Or

- (b) List and explain the uses of any two essential oil—producing plants. (CO3, K4)

14. (a) Evaluate the differences between dicot and monocot embryos. (CO4, K5)

Or

- (b) Justify the role of endosperm types in seed development. (CO4, K5)

15. (a) Evaluate the process and biological importance of double fertilization. (CO5, K5)

Or

- (b) Assess the significance of triple fusion in angiosperm reproduction. (CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Apply Bentham and Hooker's system of classification to explain the major plant groups. (CO1, K3)

Or

- (b) Illustrate and explain the structure and function of a typical herbarium sheet. (CO1, K3)

17. (a) Compare and contrast the floral features of Poaceae and Asclepiadaceae. (CO2, K5)

Or

- (b) Justify the use of a diagnostic key to differentiate the selected plant families under study. (CO2, K5)

18. (a) Analyze the various groups of plants used as economic crops under cereals and pulses. (CO3, K4)

Or

- (b) Break down the importance of beverage-yielding plants and their products. (CO3, K4)

19. (a) Critically evaluate the structure of an embryo sac (Polygonum type) and its development. (CO4, K5)

Or

- (b) Judge the embryological evidence that supports angiosperm classification. (CO4, K5)

20. (a) Design a comparative table of types of ovules with neat diagrams. (CO5, K6)

Or

- (b) Create a labeled diagram of dicot embryo and describe its parts in detail. (CO5, K6)

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**R4999**

**Sub. Code**

**548801**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Eighth Semester**

**Integrated Marine Biology**

**APPLICATION OF REMOTE SENSING AND GIS**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The primary source of energy in passive remote sensing is  
(CO1, K2)
  - (a) Artificial radar
  - (b) Laser beam
  - (c) Sun
  - (d) Microwave generator
  
2. Healthy vegetation strongly reflects in which region?  
(CO1, K1)
  - (a) Blue
  - (b) Green
  - (c) Near infrared
  - (d) Microwave

3. A sensor in remote sensing is defined as a device that (CO2, K2)
- (a) Detects and records electromagnetic radiation only
  - (b) Stores satellite images
  - (c) Measures rainfall directly
  - (d) Controls satellite motion
4. The basic principle of photogrammetry is based on (CO2, K2)
- (a) Spectral reflectance only
  - (b) Radar backscatter
  - (c) Thermal emission
  - (d) Measurement from overlapping photographs
5. Visual image interpretation is mainly based on which of the following element? (CO3, K1)
- (a) Temperature
  - (b) Pattern
  - (c) Pressure
  - (d) Density
6. Which of the following is measured using thermal remote sensing? (CO3, K1)
- (a) Emitted infrared radiation
  - (b) Reflected sunlight
  - (c) Visible light only
  - (d) X-rays

7. A low spatial resolution satellite system is mainly used for (CO4, K2)
- (a) Detailed building mapping
  - (b) Global climate monitoring
  - (c) Cadastral survey
  - (d) Street level mapping
8. Indian Remote Sensing satellites are developed by (CO4, K1)
- (a) NASA
  - (b) ESA
  - (c) ISRO
  - (d) JAXA
9. Vector data model represents features as (CO4, K2)
- (a) Pixels
  - (b) Continuous surfaces only
  - (c) Points, lines and polygons
  - (d) Grid matrices
10. Maximum likelihood classification is based on which of the following? (CO5, K1)
- (a) Visual interpretation
  - (b) Probability distribution
  - (c) Elevation data only
  - (d) Pixel brightness alone

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Examine the different types of remote sensing based on energy source. (CO1, K3)

Or

- (b) Illustrate the reflectance properties of water bodies (CO1, K3)

12. (a) Classify sensors into active and passive types with examples. (CO2, K4)

Or

- (b) Outline the structure and working of an aerial camera. (CO2, K4)

13. (a) Evaluate the key elements of visual image interpretation with suitable examples. (CO3, K5)

Or

- (b) Assess the advantages of microwave sensing over optical sensing. (CO3, K5)

14. (a) Illustrate the concept of spatial resolution with suitable examples. (CO4, K4)

Or

- (b) Classify the major Earth observation satellite systems based on their applications. (CO4, K4)

15. (a) Evaluate the advantages of GIS in spatial decision-making. (CO4, K5)

Or

- (b) Assess the principles of digital image classification. (CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Classify different types of remote sensing based on energy source. (CO1, K4)

Or

- (b) Infer the interaction of electromagnetic energy with vegetation. (CO1, K4)

17. (a) Evaluate the working principle of radar as an active sensor. (CO2, K5)

Or

- (b) Justify the applications of multispectral scanners in resource mapping. (CO2, K5)

18. (a) Formulate an essay on the role of remote sensing in geological and soil mapping. (CO3, K6)

Or

- (b) Compose a detailed report on the applications of remote sensing in agriculture, forestry and rangeland management. (CO3, K6)

19. (a) Evaluate the importance of Earth observation systems in environmental monitoring. (CO4, K5)

Or

- (b) Assess the role of ocean-monitoring satellites in marine studies. (CO4, K5)

20. (a) Classify the components of a GIS system and explain the role of each component. (CO5, K4)

Or

- (b) Analyze the applications of GIS and image classification in natural resource management. (CO5, K4)
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**R5000**

**Sub. Code**

**548802**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Eighth Semester**

**Integrated Marine Biology**

**EVOLUTION**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the objective type questions by choosing the correct option.

1. The theory of spontaneous generation (abiogenesis) was strongly supported by which Greek philosopher?  
(CO1, K1)
  - (a) Plato
  - (b) Socrates
  - (c) Aristotle
  - (d) Pythagoras
2. The Big Bang theory primarily explains the origin of  
(CO1, K2)
  - (a) The universe
  - (b) Organic molecules
  - (c) Life on Earth
  - (d) Prokaryotic cells

3. Which of the following is best known for the Cambrian period? (CO2, K1)
- (a) Origin of mammals
  - (b) First flowering plants
  - (c) Appearance of reptiles
  - (d) Explosion of marine life
4. Which of the following periods marks the beginning of the Mesozoic era? (CO2, K1)
- (a) Permian
  - (b) Triassic
  - (c) Jurassic
  - (d) Cretaceous
5. How does Neo-Lamarckism differ from Lamarckism? (CO3, K1)
- (a) It rejects inheritance
  - (b) It emphasizes genes only
  - (c) It supports inheritance influenced by environment and physiology
  - (d) It supports fossil evidence only
6. Which of the following eras is known as the “Age of Reptiles”? (CO3, K1)
- (a) Paleozoic
  - (b) Precambrian
  - (c) Mesozoic
  - (d) Cenozoic

7. Which of the following is a pre-zygotic isolating mechanism? (CO4, K1)
- (a) Hybrid sterility
  - (b) Hybrid inviability
  - (c) Temporal isolation
  - (d) Hybrid breakdown
8. \_\_\_\_\_ hominids is known as the “tool-making man”. (CO4, K2)
- (a) Australopithecus
  - (b) Homo habilis
  - (c) Homo erectus
  - (d) Homo sapiens
9. Which of the following is considered a major cause of mass extinction? (CO4, K1)
- (a) Gene mutation
  - (b) Volcanic eruption and climatic change
  - (c) Asexual reproduction
  - (d) Adaptation
10. \_\_\_\_\_ classification systems is based on evolutionary relationships. (CO5, K2)
- (a) Phenetics
  - (b) Artificial system
  - (c) Cladistics
  - (d) Numerical taxonomy

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Determine the significance of the Cosmozoic theory.  
(CO1, K3)

Or

- (b) Illustrate the views of Aristotle on the origin of life.  
(CO1, K3)

12. (a) Analyze the impact of the Devonian period on vertebrate evolution.  
(CO2, K4)

Or

- (b) Infer the significance of the Pleistocene epoch in human evolution.  
(CO2, K4)

13. (a) Evaluate Neo-Darwinism in explaining variation and natural selection.  
(CO3, K5)

Or

- (b) Assess the importance of living fossils in understanding evolution.  
(CO3, K5)

14. (a) Analyze the role of colouration in survival and adaptation of organisms.  
(CO4, K4)

Or

- (b) Outline the concepts of gene, gene pool and genotypic frequencies.  
(CO4, K4)

15. (a) Evaluate the biological and ecological consequences of extinction.  
(CO4, K5)

Or

- (b) Compare cladistics and phenetics as systems of biological classification.  
(CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Illustrate the theories of special creation and spontaneous generation. (CO1, K4)

Or

- (b) Infer the importance of experimental evidence in supporting chemical evolution theories. (CO1, K4)

17. (a) Justify the importance of the Palaeozoic era in the evolution. (CO2, K5)

Or

- (b) Compare the evolutionary significance of Paleocene and Eocene epochs. (CO2, K5)

18. (a) Formulate an essay on the contributions of Darwinism to the understanding of evolution. (CO3, K6)

Or

- (b) Develop a classification of fossils based on their mode of preservation and geological occurrence. (CO3, K6)

19. (a) Evaluate the evolutionary significance of isolating mechanisms in the formation of species. (CO4, K5)

Or

- (b) Assess the significance of Hardy-Weinberg equilibrium in population genetics. (CO4, K5)

20. (a) Analyze the major causes of mass extinction events in Earth's history. (CO5, K4)

Or

- (b) Illustrate the concept of molecular evolution with suitable examples. (CO5, K4)
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**R5001**

**Sub. Code**

**548803**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Eighth Semester**

**Integrated Marine Biology**

**BIOTECHNOLOGY**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Which enzyme is responsible for joining DNA fragments during cloning? (CO1, K2)
  - (a) Restriction endonuclease
  - (b) DNA polymerase
  - (c) RNA polymerase
  - (d) DNA ligase
2. Which type of PCR is used for quantification of gene expression? (CO1, K1)
  - (a) Nested PCR
  - (b) Multiplex PCR
  - (c) Real-time PCR
  - (d) Colony PCR

3. \_\_\_\_\_ technique is mainly used for identification of marine microbes (CO2, K2)
- (a) Western blotting
  - (b) Molecular methods
  - (c) Chromatography
  - (d) Centrifugation
4. Study of collective genomes from environmental samples is called (CO2, K1)
- (a) Proteomics
  - (b) Genomics
  - (c) Transcriptomics
  - (d) Metagenomics
5. A bioreactor operated with continuous input and output is called (CO3, K2)
- (a) Batch reactor
  - (b) Fed-batch reactor
  - (c) Continuous reactor
  - (d) Solid-state reactor

6. Which fermentation uses solid substrates without free water? (CO3, K1)
- (a) Submerged fermentation
  - (b) Continuous fermentation
  - (c) Fed-batch fermentation
  - (d) Solid-state fermentation
7. Removal of cells from fermentation broth is done by \_\_\_\_\_ (CO4, K2)
- (a) Dialysis
  - (b) Extraction
  - (c) Centrifugation
  - (d) Osmosis
8. Which method is used to break microbial cells? (CO4, K1)
- (a) Filtration
  - (b) Precipitation
  - (c) Dialysis
  - (d) Cell disruption
9. Marine bioactive compounds are mainly used in \_\_\_\_\_ (CO4, K1)
- (a) Agriculture only
  - (b) Food processing
  - (c) Pharmaceutical industry
  - (d) Textile industry

10. Which marine organism is a major source of bioactive compounds? (CO5, K1)
- (a) Birds
  - (b) Mammals
  - (c) Marine microorganisms
  - (d) Reptiles

**Part B** (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Demonstrate the  $\text{Ca}^{2+}$ -mediated transformation and electroporation in bacteria. (CO1, K3)

Or

- (b) Illustrate the chemical synthesis of oligonucleotides and its applications. (CO1, K3)

12. (a) Classify the major strategies used in marine metagenomics. (CO2, K4)

Or

- (b) Illustrate the scope of proteomics in the study of marine organisms. (CO2, K4)

13. (a) Assess the importance of bioreactors in industrial biotechnology. (CO3, K5)

Or

- (b) Justify the need for bioreactor instrumentation in process monitoring. (CO3, K5)

14. (a) Analyze filtration and centrifugation methods in product recovery. (CO4, K4)

Or

- (b) Outline the advantages and limitations of membrane-based separation processes. (CO4, K4)

15. (a) Compare chitin and chitosan with respect to structure and applications. (CO4, K5)

Or

- (b) Evaluate the applications of marine proteases and lipases in the food industry. (CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Illustrate the PEG-mediated gene transfer, gene gun method, and electroporation. (CO1, K4)

Or

- (b) Classify the different types of PCR and their application in molecular biology. (CO1, K4)

17. (a) Evaluate recent advances in marine genomics and their applications. (CO2, K5)

Or

- (b) Assess the applications of marine proteomics in environmental and biotechnological studies. (CO2, K5)

18. (a) Develop a comparative account of ideal reactor performance in bioprocesses. (CO3, K6)

Or

- (b) Design a bioreactor control strategy for temperature and pH regulation. (CO3, K6)

19. (a) Assess the role of coagulation and flocculation in biomass separation. (CO4, K5)

Or

- (b) Justify the selection of extraction and precipitation techniques in industrial bioprocessing. (CO4, K5)

20. (a) Develop a brief account on the commercial significance of marine-derived biopolymers. (CO5, K6)

Or

- (b) Design a conceptual outline for enzyme-assisted fish processing technology. (CO5, K6)
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**R5002**

**Sub. Code**

**548804**

**M.Sc. DEGREE EXAMINATION, APRIL – 2026**

**Eighth Semester**

**Integrated Marine Biology**

**POST HARVEST TECHNOLOGY**

**(CBCS – 2022 onwards)**

Time : 3 Hours

Maximum : 75 Marks

**Part A**

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The primary objective of proper onboard fish handling is to (CO1, K2)
  - (a) Increase fish weight
  - (b) Improve fish color artificially
  - (c) Maintain freshness and delay spoilage
  - (d) Increase salt content
  
2. Insulated containers are mainly used to (CO1, K2)
  - (a) Cook fish
  - (b) Maintain low temperature during transport
  - (c) Increase moisture
  - (d) Add preservatives

3. Which ATP degradation product causes bitterness in spoiled fish? (CO2, K1)
- (a) IMP
  - (b) ADP
  - (c) Inosine
  - (d) Hypoxanthine
4. Increase in bacterial load in stored fish primarily results in (CO2, K1)
- (a) Improved texture
  - (b) Spoilage and off-odour
  - (c) Increased protein content
  - (d) Increased freshness
5. Antioxidants like BHA and BHT are added primarily to (CO3, K2)
- (a) Increase pH
  - (b) Reduce protein solubility
  - (c) Prevent lipid oxidation
  - (d) Increase moisture loss
6. Which of the following factors used for sensory evaluation of fresh fish? (CO3, K1)
- (a) Bone density
  - (b) Muscle fibre count
  - (c) Fat percentage only
  - (d) Eye clarity, gill colour and odour

7. Vacuum packaging of fish primarily helps to (CO4, K2)
- (a) Increase microbial growth
  - (b) Remove oxygen and delay spoilage
  - (c) Increase pH
  - (d) Improve colour artificially
8. Which is the recommended freezing temperature of fish during shipping? (CO4, K1)
- (a)  $-5^{\circ}\text{C}$
  - (b)  $0^{\circ}\text{C}$
  - (c)  $-18^{\circ}\text{C}$  or below
  - (d)  $15^{\circ}\text{C}$
9. A sudden increase in pH of stored fish usually indicates (CO4, K2)
- (a) Freshness
  - (b) Freezing stability
  - (c) Microbial spoilage
  - (d) Increased protein synthesis
10. The international food standards body established by FAO and WHO is (CO5, K1)
- (a) USFDA
  - (b) EU Commission
  - (c) ISO
  - (d) Codex Alimentarius Commission

**Part B**

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Examine the different types of ice used in fish processing industries. (CO1, K3)

Or

- (b) Illustrate the temperature control mechanisms in refrigerated sea water systems. (CO1, K3)

12. (a) Classify the stages of post-mortem changes in fish and explain their characteristics. (CO2, K4)

Or

- (b) Outline the sequence and importance of pre-treatment operations in fish processing. (CO2, K4)

13. (a) Evaluate the need for chemical treatments before freezing in fish processing. (CO3, K5)

Or

- (b) Compare quality control measures for fresh fish and frozen fish products. (CO3, K5)

14. (a) Outline the manufacture and identification methods of laminated packaging materials. (CO4, K4)

Or

- (b) Analyze the importance of cold chain maintenance in shipping frozen fish. (CO4, K4)

15. (a) Assess the relationship between microbial load and chemical spoilage indicators in fish. (CO4, K5)

Or

- (b) Outline the major national and international seafood quality standards. (CO5, K5)

**Part C**

(5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Analyze the factors affecting quality deterioration of fish during onshore handling. (CO1, K4)

Or

- (b) Illustrate the working principle of refrigerated sea water systems in fish preservation. (CO1, K4)

17. (a) Assess the mechanism of rigor mortis development and resolution in fish muscle. (CO2, K5)

Or

- (b) Evaluate the relationship between bacterial load and sensory changes in fish. (CO2, K5)

18. (a) Compose an elaborate note on different methods of freezing used in fish processing industries. (CO3, K6)

Or

- (b) Formulate an essay on the sanitation procedures followed in fish processing plants. (CO3, K6)

19. (a) Evaluate the role of multilayer laminates in extending shelf life of processed fish. (CO4, K5)

Or

- (b) Evaluate the effectiveness of insulated and refrigerated packaging systems in maintaining fish quality. (CO4, K5)

20. (a) Illustrate the different methods of quality assessment in fish and fishery products. (CO5, K4)

Or

- (b) Classify the components of Good Manufacturing Practices in seafood processing plants. (CO5, K4)

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