

BIOLOGY FOR ENGINEERS
(BIOT 4223)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which of the following cell organelles does not contain DNA?
 - (a) Nucleus
 - (b) Lysosome
 - (c) Chloroplast
 - (d) Mitochondria
- (ii) Which of the following is/are found in plant cells but not in those of animals?
 - (a) Cell wall and lysozyme
 - (b) Chromosome
 - (c) Mitochondria and Golgi apparatus
 - (d) Plastids and cellular wall
- (iii) Which of the following statements about cell theory is true?
 - (a) Cell theory does not apply to virus
 - (b) Cell theory does not apply to microbes
 - (c) Cell theory does not apply to algae
 - (d) Cell theory does not apply to fungi
- (iv) Nuclear DNA replicates in _____ phase
 - (a) G2 phase
 - (b) S Phase
 - (c) M Phase
 - (d) None of the above
- (v) Which of the following is a type of inheritance?
 - (a) Complete dominance
 - (b) Sex linked
 - (c) Incomplete dominance
 - (d) All of above

- (vi) The coenzyme is
 (a) Often a metal
 (b) Always a metal
 (c) Often a Vitamin
 (d) Always an organic compound
- (vii) Which of these is a suitable ex-situ conservation method?
 (a) National Park
 (b) Wildlife Sanctuary
 (c) Sacred Groves
 (d) Seed Bank
- (viii) Starch is a
 (a) A polymer of Sucrose
 (b) A polymer of Lactose
 (c) A polymer of Cellulose
 (d) A polymer of Glucose
- (ix) _____ is defined as the number of species represented in a specific region, landscape or ecological community.
 (a) Coevolution
 (b) Commensalism
 (c) Species richness
 (d) Population density
- (x) When the physical change produced in a biosensor is due to the movement of electrons produced in a redox reaction, the biosensor is referred to as _____.
 (a) calorimetric biosensor
 (b) potentiometric biosensor
 (c) piezo-electric biosensor
 (d) amperometric biosensor

Fill in the blanks with the correct word

- (xi) Protein synthesis occurs in _____ phase of cell cycle.
- (xii) Cells were first observed in cork by _____ in 1665.
- (xiii) The genetic code is _____.
- (xiv) The protein part of an enzyme is called _____.
- (xv) _____ is an enzyme responsible for breaking of bonds.

Group - B

2. (a) What are the postulates of modern cell theory? [[CO1](Remember/LOCQ)]
- (b) Explain in detail the various objections to cell theory. [[CO1](Understand/LOCQ)]
- (c) Analyze the difference between cell wall of plant cell and cell membrane of animal cell. [[CO1](Analyze/IOCQ)]

4 + 4 + 4 = 12

3. (a) Distinguish between DNA and RNA in terms of its structure and function. [[CO4](Understand/LOCQ)]
 (b) What is the central dogma of molecular biology? [[CO4](Remember/LOCQ)]
 (c) Analyze the salient features of genetic code. [[CO4](Analyze/IOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Proteins have four main structures and two main shapes. Justify this statement. [[CO3](Analyze/IOCQ)]
 (b) Illustrate how a peptide bond is formed between two amino acids and an ester bond between alcohol and fatty acid. [[CO3](Understand/LOCQ)]
 (c) Classify the lipids in terms of structure and function. [[CO3](Remember/LOCQ)]
4 + 4 + 4 = 12
5. (a) What the different functions of carbohydrates. [[CO3](Remember/LOCQ)]
 (b) Illustrate the formation of disaccharides (i) Sucrose, (ii) Lactose and (iii) Maltose from their monosaccharides. [[CO3](Understand/LOCQ)]
 (c) Analyze in detail about the concept of zwitterionic form of amino acids. [[CO3](Analyze/IOCQ)]
2 + (2 + 2 + 2) + 4 = 12

Group - D

6. (a) What are co-factors? Describe the two major classes of co-factors with examples. [[CO5](Remember/LOCQ)]
 (b) What do you mean by intracellular and extracellular enzymes? Give examples. [[CO5](Remember/LOCQ)]
 (c) Comment on the general properties of enzymes. [[CO5](Remember/LOCQ)]
(1 + 3) + 4 + 4 = 12
7. (a) Evaluate the molecular mechanism of action of restriction enzymes. [[CO5](Understand/LOCQ)]
 (b) Explain the nomenclature of restriction enzymes with the example of *EcoRI* [[CO5](Understand/LOCQ)]
 (c) Compare between Type-I, Type-II and Type-III restriction enzymes. [[CO5](Compare/IOCQ)]
4 + 4 + 4 = 12

Group - E

8. (a) Compare between alpha, beta and gamma biodiversity. [[CO6](Compare/IOCQ)]
 (b) What are the threats to biodiversity? [[CO6](Remember/LOCQ)]
 (c) Describe briefly the importance of biodiversity hotspots. [[CO6](Understand/IOCQ)]
4 + 4 + 4 = 12

9. (a) Distinguish between ex-situ and in-situ conservation methods. [[CO6](Differentiate/IOCQ)]
- (b) Comment on the advantages and disadvantages of Bioremediation. [[CO6] (Remember/LOCQ)]
- (c) Discuss about recent advances in engineering designs inspired by examples in biology. [[CO6](Apply/HOCQ)]
- 4 + 4 + 4 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	62.5	33.33	4.16

Course Outcome (CO):

After completion of the course, the students will be able to:

1. Understand the basic structure and function of cells and cellular organelles.
2. Understand the fundamental concepts of DNA, RNA and central dogma of cells.
3. Characterize the different types of proteins, lipids and carbohydrates.
4. Analyze the mechanism of inheritance of characters through generations.
5. Understand and implement the working principles of enzymes and their applications in biological systems and industry.
6. Design and evaluate different environmental engineering projects with respect to background knowledge about bioresources, biosafety and bioremediation.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.