BIOLOGY FOR ENGINEERS
(BIOT 4223)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which of the following cell organelles is absent in animal cells and present in plant cell?
(a) Mitochondria (b) Cytoplasm
(c) Cell wall (d) Vacuoles.

(ii) Which of the following cell organelles does not contain DNA?
(a) Nucleus (b) Lysosome
(c) Chloroplast (d) Mitochondria.

(iii) An exception to Mendel's law is
(a) purity of gametes (b) dominance
(c) independent assortment (d) linkage.

(iv) The centromere is the part of the chromosome where
(a) chromatids are attached (b) nucleoli are formed
(c) crossing-over takes place (d) nicking occurs.

(v) What is the net gain of ATP during the conversion of glucose to pyruvate
(a) 6 ATP (b) 2 ATP
(c) 4 ATP (d) 1 ATP + 1 GTP.

(vi) The coenzyme is
(a) often a metal (b) always a protein
(c) often a vitamin (d) always an inorganic compound.

(vii) Which of the following hormones is responsible for increasing gluconeogenesis in the liver during prolonged starvation?
(a) Insulin (b) Glucagon
(c) TSH (d) Thyroxine.

(viii) Which of the following is produced with the combination of Apoenzyme and Coenzyme?
(a) Holoenzyme (b) Enzyme-substrate complex
(c) Prosthetic group (d) Product.

(ix) _____ is a biodiversity hotspot in India.
(a) Gangetic plain (b) Sunderbans
(c) Eastern Ghats (d) Western Ghats

(x) Which of these is a suitable ex-situ conservation method?
(a) National Park (b) Wildlife Sanctuary
(c) Sacred Groves (d) Seed Bank.

Group- B

2. (a) Explain the process of replication. [(CO2) (Understanding/LOCQ)]
(b) Why is genetic code described as triplet code? [(CO2) (Understanding/LOCQ)]
(c) Differentiate between transcription and translation. [(CO2)(Analyze/LOCQ)]
4 + 4 + 4 = 12

3. (a) Why mitochondria is called the power house of cell? [(CO1)(Remember/LOCQ)]
(b) How is DNA different from RNA? [(CO2)(Understand/LOCQ)]
(c) Discuss steps of replication of DNA using a suitable diagram. [(CO2)(Analyse/IOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) What are the four main phases of cell cycle? [(CO2)(Remember/LOCQ)]
(b) Analyze the significance of mitosis and meiosis in cell division process. [(CO2)(Analyze/LOCQ)]
(c) Distinguish between apoptosis and necrosis. [(CO2)(Analyze/IOCQ)]
4 + 4 + 4 = 12

5. (a) What are the two phases of Glycolysis? Describe each phases. [(CO2)(Understand/LOCQ)]
(b) What is a test-cross? Deduce its significance. [(CO4)(Understand/LOCQ)]
(c) Using a suitable example, calculate the outcomes of a Mendelian dihybrid cross. [(CO4)(Evaluate/HOCQ)]
4 + 4 + 4 = 12

Group - D

6. (a) Evaluate how co-factors help in the enzyme action. [(CO5)(Evaluate/HOCQ)]
(b) Discuss the action of apoenzymes and holoenzymes in enzyme activity. [(CO5)(Remember/LOCQ)]

(c) What are intracellular and extracellular enzymes? Give examples. [(CO5)(Analyze/IOCQ)]

4 + 4 + 4 = 12

7. (a) Give a comparative analysis between Type-I, Type-II and Type-II restriction enzymes. [(CO5)(Differentiate/IOCQ)]
   (b) Evaluate the principle of nomenclature of restriction enzymes with the example of *Eco*RI. [(CO5)(Evaluate/HOCQ)]
   (c) Comment on the applications of restriction enzymes in research and diagnostics. [(CO5)(Analyze/IOCQ)]

4 + 4 + 4 = 12

Group - E

8. (a) What do you mean by Richness and evenness of biodiversity? [(CO6)(Remember/LOCQ)]
   (b) Differentiate between alpha, beta and gamma biodiversity. [(CO6)(Differentiate/IOCQ)]
   (c) Examine the importance of biodiversity hotspots. [(CO6)(Examine/HOCQ)]

4 + 4 + 4 = 12

9. (a) Analyze the working principle of a typical biosensor with a suitable diagram. [(CO6)(Analyze/IOCQ)]
   (b) Write short notes on ***any one***:
   (i) Peizo-electric biosensor
   (ii) Thermostatic biosensor
   (iii) Optical biosensor. [(CO6)(Understand/LOCQ)]
   (c) Give a critical appreciation on the applications of biosensors in different industrial sectors. [(CO6)(Criticize/HOCQ)]

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	29	21

Course Outcomes (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 cellular reproduction and cell metabolism.
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