BIOPOLYMER
(BIOT 4126)

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 is not an example of a natural biodegradable polymer?
(a) Collagen (b) Polyvinyl alcohol
(c) Lignin (d) Natural rubber.

(ii) For skin grafting the scaffold used should be
(a) Biodegradable (b) Biocompatible
(c) Bioactive (d) Both (a) and (b).

(iii) Which of the following is an example of Synthetic polymer?
(a) Dextran (b) Chitin (c) Amylose (d) Polylactic ac.

(iv) Which of the following have a structure with three peptide chains bound with each other to form a rope-like structure?
(a) Collagen (b) DNA (c) RNA (d) Peptidoglycan.

(v) Which statement best describes a biodegradable material?
(a) A material made from plant
(b) A material that can be degraded by bacteria
(c) A material that is organically produced
(d) A material that is sustainable.

(vi) Which compound is a mostly used as a plasticizer for making starch-based bioplastics?
(a) Cellulose (b) Glycerol and xylitol
(c) Acetic acid and glycerol (d) Sulphuric acid.

(vii) Which of the following statements is correct?
(a) Bioplastics are toxic
(b) Bioplastics are more durable than conventional plastics
(c) Conventional plastics have direct relation to development of petroleum industries
(d) Bioplastics are not polymers.

(viii) Which of the following is not related to biodegradation process?
(a) Oxygen (b) Microorganisms
(c) Adhesive (d) Evolution of carbon dioxide.

(ix) Corn can be used for making
(a) Starch-based biplastic (b) Cellulose-based bioplastic
(c) Protein based bioplastic (d) None of these.

(x) IR spectroscopy is used for measuring the biodegradation rate of a biopolymer. For which method it is used?
(a) Oxygen consumption (b) Carbon dioxide release
(c) Estimation of amylase activity (d) Determination of growth of microbes.

Group- B

2. (a) Analyse the various beneficial effects of hyaluronic acid in mammalian systems. [(CO1)(Analyse/IOCQ)]
(b) Determine how hyaluronic acid can be industrially obtained by the use of a flow-chart. [(CO1)(Evaluate/HOCQ)]
(c) Discuss in detail the various extraction processes of collagen. [(CO3)(Analyze/IOCQ)]
4 + 4 + 4 = 12

3. (a) What are the various properties of biomaterials? [(CO1)(Remember/LOCQ)]
(b) Describe in detail and classify type of carbohydrate material is used for biomaterials. [(CO3)(Analyse/IOCQ)]
(c) How is collagen synthesized? [(CO3)(Remember/LOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Analyse the process of extracting silk from silk fibroin. [(CO2)(Analyse/IOCQ)]
(b) Explain the various applications of silk fibroin. [(CO2)(Evaluate/HOCQ)]
(c) Distinguish how silk fibroin and hyaluronic acid can be used in wound healing processes. [(CO1)(Analyze/IOCQ)]
4 + 4 + 4 = 12

5. (a) Distinguish between chitin and chitosan. [(CO3)(Understand/LOCQ)]
(b) Chitosan can be used as an efficient biomaterial. Analyse this statement. [(CO3)(Analyse/IOCQ)]
(c) What is dextran and why it has many applications as biomaterials? [(CO3)(Analyze/IOCQ)]
4 + 4 + 4 = 12

Group – D

6. (a) What are bioplastics? Define the following terms in relation to bioplastics:
(i) degradable and (ii) compostable [(CO4)(Remember/LOCQ)]

(b) Discuss three areas where bioplastics have started replacing conventional plastics.
[(CO4)(Understand/IOCQ)]
(2 + 2 + 2) + 6 = 12

7. (a) State three properties of starch. What is gelatinization of starch?
[(CO3)(Remember/LOCQ)]
(b) Why starch alone cannot form bioplastic? How the problem is solved?
[(CO4)(Solve/HOCQ)]
(c) State two uses of starch as a bioplastic. [(CO4)(Remember/LOCQ)]
(3 + 3) + (1 + 3) + 2 = 12

Group - E

8. (a) What is PLA? State its chemical nature. Name the enzyme that can degrade PLA. Discuss how can you determine the activity of the enzyme?
[(CO6)(Understand/IOCQ)]
(b) Name the enzyme that can degrade cellulose-based biopolymers. Design an experiment to measure the degradability of a cellulose-based biopolymer using this enzyme.
[(CO6)(Design/HOCQ)]
(2 + 1 + 1 + 4) + (1 + 3) = 12

9. (a) What is composting? Do you think composting is associated with biodegradation of a polymer? Justify your answer. [(CO6)(Understand, Justify/IOCQ, HOCQ)]
(b) Discuss how carbon dioxide evolution helps to determine the biodegradability of a substance.
[(CO6)(Understand/IOCQ)]
(2 + 4) + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.08	50	22.92

Course Outcome (CO):

At the end of this course:
1. Students will acquire basic knowledge of biopolymer and can classify biopolymer according to their composition.
2. Students will get familiar with the structures, properties and applications of different protein based biomaterial.
3. Students will be able to explain the structures, properties and applications of different carbohydrate based biomaterial.

4. Students will comprehend the knowledge of different type and applications of bioplastics.
5. Students will learn about the different composite material that can be used as biomaterial. They will be familiar with the applications, advantages and disadvantages of bioplastics and composite materials.
6. Students will classify biodegradable polymer and will analyze the biodegradation techniques.

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