

BIOPOLYMER
(BIOT 4126)

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 is NOT an example of a natural biodegradable polymer?
(a) Collagen (b) Polyvinyl alcohol
(c) Lignin (d) Natural rubber.
- (ii) _____ polymers are conserved to possess the property of biocompatibility.
(a) Bioequivalent (b) Man-made
(c) Biodegradable (d) Bio available
- (iii) Which of the following is an example of Synthetic polymer?
(a) Dextran (b) Chitin
(c) Amylose (d) Poly-ethylene.
- (iv) Alginate is used in
(a) making confectioneries (b) making fabric
(c) clearing of fruit juice (d) none of the above.
- (v) Hyaluronic acid plays an important role in _____
(a) wound healing (b) adhesion
(c) migration (d) differentiation.
- (vi) Polysaccharides mostly used for making bioplastics include
(a) Starch, Cellulose and Collagen (b) Starch, Cellulose and Lignocellulose
(c) Collagen, Starch and Gluten (d) All of these.
- (vii) How much percentage of constituents of a plastic material should be from biological origin to be marked as bioplastic?
(a) 20% (b) 30% (c) 50% (d) 80%.
- (viii) Chemical nature of dextran is
(a) Polysaccharide (b) Protein
(c) Amino acid (d) Polymer of hydrocarbon.

- (ix) How crystallinity affects the degradability of a biopolymer?
 (a) Crystalline regions are more readily degradable
 (b) Crystalline regions are less readily degradable
 (c) Crystallinity does not affect degradability
 (d) None of the statements are correct.
- (x) Which enzyme is responsible for breaking a polyester compound?
 (a) Protease (b) Amylase (c) Esterase (d) Cellulase.

Fill in the blanks with the correct word

- (xi) Amylose contains _____ bond.
- (xii) Examples of synthetic polymers used as biomaterials _____.
- (xiii) The biopolymer used for making gelatin is _____.
- (xiv) Amylopectin consists of _____ linkage which makes it a branched chain polymers.
- (xv) Name of the enzyme which can digest starch is _____.

Group - B

2. (a) Analyze the various properties of biomaterials. [[CO1](Analyze/IOCQ)]
 (b) Give a comparison between various types of biomaterials in terms of its advantages, disadvantages and its examples. [[CO1](Understand/LOCQ)]
 (c) What are the unique properties of HA that make it appropriate as skin and anti-aging. [[CO1](Apply/IOCQ)]
4 + 4 + 4 = 12
3. (a) How are scaffolds synthesized? [[CO1](Understanding/LOCQ)]
 (b) Analyze how are bioreactors used in tissue engineering purposes? [[CO1](Analyze/IOCQ)]
 (c) What are the properties of silk fibroin? [[CO1](Remembering/LOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Analyse the different starch based polymers. [[CO3](Analyze/IOCQ)]
 (b) What factors determine degradation of biopolymer? [[CO6](Remember/LOCQ)]
 (c) Analyse the various medical application of collagen with respect to its advantages and disadvantages of using as a potential biomaterial. [[CO3](Analyze/IOCQ)]
4 + 4 + 4 = 12
5. (a) How are collagen fibres synthesized? [[CO3](Analyze/HOCQ)]
 (b) Discuss about the salt ppt. method of collagen extraction. [[CO3](Remember/LOCQ)]
 (c) Write on any two of the following : (i) Pharmaceutical Excipient, (ii) Plasma volume expander and (iii) Artificial RBC's [[CO3](Apply/IOCQ)]
4 + 4 + (2 + 2) = 12

Group - D

6. (a) What are conventional plastics? Compare the advantages and disadvantages of conventional plastics and bioplastics. *[[CO5](Remember, Compare/LOCQ, HOCQ)]*
(b) Why polystyrene is considered the worst type of conventional plastic? *[[CO5](Understand/IOCQ)]*
(2 + 6) + 4 = 12
7. (a) What is the monomeric compound of PLA? Name the two isomers of the monomers. State how the ratio of the two isomers affects the property of PLA. *[[CO5](Remember/LOCQ)]*
(b) PLA is a good material for tissue engineering. Justify the statement. *[[CO5](Justify/HOCQ)]*
(c) Describe the degradation process of PLA. *[[CO5](Describe/IOCQ)]*
(1 + 1 + 2) + 4 + 4 = 12

Group - E

8. (a) Describe the method for degradation of a biopolymer in soil. *[[CO6](Describe/IOCQ)]*
(b) Name the enzyme that can breakdown starch-based biopolymer. How the enzyme activity is estimated? How it can be applied to the degradation of biopolymer? *[[CO6](Apply/IOCQ)]*
(c) How biodegradability can be estimated by measuring oxygen consumption? *[[CO6](Apply/IOCQ)]*
4 + (1 + 3 + 2) + 2 = 12
9. (a) What is composting? Describe industrial composting for biodegradable plastics. *[[CO6](Describe/IOCQ)]*
(b) In industrial composting, rate of degradation of a biopolymer increases as the process progresses. Justify the observation. *[[CO6](Justify/HOCQ)]*
(c) Discuss anaerobic digestion for degradation of a biopolymer. *[[CO6](Discuss/IOCQ)]*
(2 + 4) + 3 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.08	55.21	17.71

Course Outcome (CO):

After the completion of the course students will be able to

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.

