BIOMATERIALS

(BIOT 4162)

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) The characteristic that results in permanent material deformation is
(a) fatigue resistance   (b) visco-elasticity
(c) plasticity   (d) anisotropism.

(ii) Soybean peroxidase catalyses the polymerization of
(a) polyphenol   (b) polycaprolactone
(c) polyhydroxybutyrate   (c) BIOPOL.

(iii) Soft contact lens is made up of
(a) polycarbonate   (b) polyurethane
(c) BIOPOL   (d) polycaprolactone.

(iv) An example of a natural biomaterial that can be enzymatically degraded is
(a) poly-lactic acid   (b) poly-glycolic acid
(c) ceramic   (d) collagen.

(v) A biomaterial should be
(a) biodegradable   (b) biocompatible
(c) bioresorbable   (d) all of these.

(vi) BIOPOL is composed of
(a) polyhydroxyoctanoate
(b) poly(hydroxyoctanoate- polyhydroxyvalerate)
(c) polyhydroxyvalerate
(d) poly(hydroxybutyrate- polyhydroxyvalerate).

(vii) BIOPOL is industrially produced by fermentation of
(a) leuconostoc mesenteroids   (b) alcaligenes eutrophus
(c) bombyx mori   (d) none of these.

(viii) Polycaprolactone is used in
(a) cosmetics   (b) wound care
(c) drug delivery   (d) none of these.

(ix) Size of a polymer depends on
(a) degree of polymerization   (b) polydispersity Index
(c) molecular weight   (d) tensile strength.

(x) Resilon is composed of a parent polymer of
(a) BIOPOL   (b) polycaprolactone
(c) polyphenol   (d) polyvalerate.

Group - B

2. (a) Define biomaterials.

(b) What are the basic properties of biomaterials?

(c) What are the medical uses of collagen?

(d) What is collasome?

(e) Write down the advantages and disadvantages of collagen when used as biomaterial.

1 + 6 + 2 + 1 + 2 = 12

3. (a) Write short notes on
(i) Biocompatibility
(ii) Sterilization of biomaterials

(b) What is the repetitive sequence of silk fibroin? What is the importance of this sequence in the secondary structure of fibroin? What are the advantages of using fibroin as biomaterial?

(4 + 4) + (1 + 1 + 2) = 12

Group - C

4. (a) Give examples of two bacteria that can produce cellulose.

(b) Compare between cellulose obtained from plant and bacteria.

(c) Discuss about the biochemical pathway for cellulose synthesis with a flowchart indicating all the details.

2 + 3 + 7 = 12

5. (a) What do you mean by M and G content of alginic acid? Discuss the effect of G content on the strength of alginic acid. Discuss the application of alginate.

(b) What is electrospinning? What are the applications of chitosan nanofibers?

$$(2+ 2+ 4) + (2 + 2) = 12$$

Group - D

6.(a) Name one modified carbohydrate that can be used as lubricating agent. Describe its occurrence, property and structure.

(b) What are the medical applications of this compound?

$$(1+ 6) + 5 = 12$$

7.(a) Describe the pathway of BIOPOL synthesis.

(b) Explain why E. coli is used to produce PHB.

(c) Write three applications of BIOPOL.

$$5 + 4 + 3 = 12$$

Group - E

8. (a) Describe with a diagram a typical Stress-strain curve.

(b) Explain the Voigt-Kelvin model of visco-elasticity.

$$7 + 5 = 12$$

9.(a) Following data were obtained for polymethyl methacrylate [monomer $H_2C=C(CH_3)COOCH_3$]

Mean Molecular Wt.(Mi) (gm/mole)	40,000	80,000	1,00,000
Weight (gm)	2	1	1

Calculate Number average molecular weight (Mn), Weight average molecular weight (Mw), Polydispersity Index (PDI) and Degree of Polymerization (DP).

(b) Briefly explain the different polymer topologies.

$$8 + 4 = 12$$