

**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) Blood is a Non-newtonian fluid of the type

(a) pseudoplastic	(b) dilatant
(c) bingham plastic	(d) thixotropic liquid.
 - (ii) Factors decreasing the Glass Transition Temperature (T_g) of a polymer

(a) plasticizers	(b) cross-linking between chains
(c) increase in surrounding pressure	(d) presence of bulky groups in chains.
 - (iii) Creep recovery test involves loading a material at

(a) constant stress	(b) constant strain
(c) constant shear rate	(d) none of these.
 - (iv) Microorganisms secrete an enzyme which helps in digestion of cellulose known as

(a) cellulase	(b) catalase
(c) sucrase	(d) pepsin.
 - (v) Silk fibroin consists of polypeptide chains arranged in

(a) alpha helix	(b) beta-pleated sheet
(c) beta helix	(d) none of these.
 - (vi) The point after which any continuous stress results in permanent deformation is known as

(a) proportional limit	(b) elastic limit
(c) ultimate point	(d) none of these.

- (vii) A material that is experiencing recoverable strain is actually undergoing

(a) elastic deformation	(b) plastic deformation
(c) fatigue resistance	(d) tensile load.
- (viii) Polydispersity Index of polymer chains having uniform chain length is equal to

(a) 0	(b) 1	(c) 100	(d) none of these.
-------	-------	---------	--------------------
- (ix) Elastin is a

(a) carbohydrate	(b) protein
(c) polysaccharide	(d) fat.
- (x) Which among the following is an antioxidant?

(a) Polyphenol	(b) BIOPOL
(c) PHB	(d) Polycaprolactone.

Group - B

2. (a) How is biomaterial different from biological material?
- (b) What are the difference between the traditional material and biological soft issue in terms of mechanical property?
- (c) What are the applications of collagen and keratin as biomaterial?
- (d) What are the advantages of using recombinant collagen over mammalian collagen as biomaterial?
- (e) Write down the two cell adhesion sequences present in keratin protein.

2 + 3 + 4 + 2 + 1 = 12

3. (a) What are the different types of material that can be used as biomaterial?
- (b) Discuss about the different properties of biomaterials.

5 + 7 = 12

Group - C

4. (a) What are the factors that affect electrospinning process? Briefly discuss about them. Name two solvents that can be used for electrospinning process.
- (b) Name two brown algae and two bacteria that can produce alginate. Why mammals cannot degrade alginate? Which enzyme is responsible for degradation of alginate?

- (c) What is agarose? What are the properties of agarose?

$$(5 + 1) + (1 + 1 + 1) + (1 + 2) = 12$$

5. (a) Write down the structure of amylose and amylopectin.
 (b) What are the different applications of starch as biomaterial?
 (c) What are the limitations of starch as biomaterial? Give one practical example.
 (d) How is starch is used in colon specific drug delivery?

$$2 + 6 + 2 + 2 = 12$$

Group - D

6. (a) What is dextran? What is the difference between dextran and dextrin? Name one bacteria that synthesizes dextran. What are the applications of dextran?
 (b) Discuss the properties and application of hyaluronic acid.

$$(1 + 1 + 1 + 4) + 5 = 12$$

7. (a) What is BIOPOL? Write down the properties of BIOPOL.
 (b) Briefly discuss the synthesis of polyphenol.
 (c) Write down the applications of polyphenol.

$$(1 + 4) + 3 + 4 = 12$$

Group - E

8. (a) The viscosity data on cellulose acetate solution in toluene at 25°C at different polymer concentrations are given below:

Concentration (g/dl)	0.15	0.22	0.27	0.33
Specific Viscosity	0.2475	0.385	0.50	0.627
Reduced Viscosity (dl/g)	1.65	1.75	1.85	1.9

Calculate the molecular weight (M_w) of the polymer using Mark-Houwink Equation and their constant at 25°C are $K = 51.3 \times 10^{-3}$ ml/g, $a = 0.69$.

- (b) What do you mean by number average molecular weight and weight average molecular weight?

$$8 + (2 + 2) = 12$$

9. (a) What do you mean by creep recovery test and stress relaxation test?

- (b) Explain why high-density polyethylene is harder than low density polyethylene.
 (c) The amount of elasticity of a material is determined by two types of material parameter – explain.

$$(3 + 3) + 3 + 3 = 12$$