

**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) Toothpaste is a Non-newtonian fluid of the type
 (a) Pseudoplastic (b) Dilatant
 (c) Bingham Plastic (d) Thixotropic liquid.
- (ii) Rubber is more elastic as compared to metals since it has
 (a) Higher modulus and lower elastic limit
 (b) Lower modulus and higher elastic limit
 (c) Both modulus and elastic limit are higher
 (d) Both modulus and elastic limit are lower
- (iii) What is the general formula for carbohydrate
 (a) $(CH_2O)_n$ (b) $(C_2HO)_n$
 (c) $(CHCHCH)$ (d) $(CHO_2)_n$.
- (iv) Visco-elasticity of a polymer is presented by
 (a) Newton's model (b) Maxwell and voigt model
 (c) Hooke's model (d) Burger model.
- (v) Resilon is composed of a parent polymer of
 (a) BIOPOL (b) Polycaprolactone
 (c) Polyphenol (d) Polyvalerate.
- (vi) An example of a natural (bio)material that can be enzymatically degraded
 (a) Poly-lactic acid (b) Poly-glycolic acid
 (c) Ceramic (d) Collagen.
- (vii) The material characteristic that results in permanent material deformation is
 (a) Fatigue resistance (b) Visco-elasticity
 (c) Plasticity (d) Anisotropism.

- (viii) The secondary structure of collagen protein is
 (a) Left handed α helix (b) Right handed α helix
 (c) β sheet (d) β turn.
- (ix) Size of a polymer depends on
 (a) Degree of polymerization (b) Polydispersity Index
 (c) Molecular weight (d) Tensile strength.
- (x) A biomaterial should be
 (a) Biodegradable (b) Biocompatible
 (c) Bioresorbable (d) All of (a), (b) and (c).

Group - B

2. (a) Define biomaterials with proper examples.
 (b) What are the different properties of biomaterials?
 (c) Draw the stress-strain curve of traditional material and biological soft tissue with proper labelling.

2 + 6 + 4 = 12

3. (a) What are the different applications of collagen and keratin as biomaterials? What are the characteristic repetitive sequences of collagen and keratin?
 (b) What is the repetitive sequence of silk fibroin? What is the importance of this sequence in the secondary structure of fibroin?

(3 + 2 + 3) + (2 + 2) = 12

Group - C

4. (a) Draw the structures of amylose and amylopectin. What are the different applications of starch as biomaterial?
 (b) What are the two enzymes that can be used in modifications of starch? How they modify starch?

(4 + 5) + (2 + 1) = 12

5. (a) Discuss about the modifications of chitosan and alginate.
 (b) How can you make alginate biodegradable?
 (c) What is cell interactive alginate?

(5 + 3) + 2 + 2 = 12

Group - D

6. (a) What is dextran? How dextran is different from dextrin? Name one bacteria that is used commercially for synthesis of dextran.

(b) How dextran can act as antithrombotic agent? What are the other applications of dextran? Which enzyme can degrade dextran and where it is present in human body?

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

7. (a) Explain why *E.coli* is used to produce PHB.

(b) Briefly discuss the properties of PHB.

(c) Write down the applications of polycaprolactone.

$$4 + 4 + 4 = 12$$

Group - E

8. (a) Explain Maxwell model of viscoelasticity.

(b) Explain the different factors effecting the Glass transition temperature.

$$7 + 5 = 12$$

9. (a) What do you mean by a Non-newtonian fluid? Explain with examples different types of Non-newtonian fluid.

(b) What is Polydispersity Index and Degree of polymerization?

$$(2 + 6) + 4 = 12$$