BIOMATERIALS
(BIOT 4131)

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 amino acids is most abundant in collagen fibers?
(a) Hydroxyproline (b) Proline
(c) Glycine (d) Lysine

(ii) _____ is used as an anti-aging treatment
(a) Silk fibroin (b) PHB
(c) Collagen (d) BIOPOL

(iii) _____ is one of the most important aspects of biomaterial-tissue interactions.
(a) Biocompatibility (b) Bioavailability
(c) Bioequivalence (d) Bioluminescence

(iv) Biomaterials are intended to _____.
I. Replace a body part
II. Regenerate an organ
III. Augment function
(a) I, II, and III (b) I only
(c) I and II only (d) III only

(v) Hydrogels consist of _____ functional groups.
(a) hydrophilic (b) hydrophobic
(c) polar (d) positively charged

(vi) Which is the main ingredient in Sculptra?
(a) PHB (b) Polylactic acid
(c) Polycaprolactone (d) Polyphenol

(vii) Which one among the following is a Polyesters?
(a) Alginate (b) Fibroin
(c) Polyhydroxybutyrate (d) Hyaluronic acid

(viii) Enzymes catalyzing the conversion of 3-hydroxy butyrate to acetoacetate is
(a) Ketothiolase (b) 3-hydroxy butyrate dehydrogenase
(c) PHB synthase (d) PHB polymerase

(ix) Viscoelasticity exhibits which of the following properties?
(a) Time-dependent
(b) Temperature-dependent
(c) Temperature and time dependent
(d) Temperature and time independent

(x) Which of the following is a characterization technique used to measure Young's modulus of a biomaterial?
(a) Tensile test
(b) Compression test
(c) Three- and four-point bend test
(d) Calculation from the stress-strain curve

Fill in the blanks with the correct word

(xi) Nitinol is _____alloy.

(xii) The elastic component of viscoelastic material is modeled as _____

(xiii) The heat capacity of a material defined as _____

(xiv) Ceramic materials do not have _____ region in stress strain curve.

(xv) Stress –strain relationship of an elastic material is given by _____ law.

Group - B

2. (a) Classify the natural polymers used as biomaterials. *[(CO1)(Classify/LOCQ)]*
(b) How can you purify the collagen from mixture of proteins? *[(CO3)(Apply/IOCQ)]*
(c) What do you mean by a tissue engineering triad? *[(CO1)(Remember/LOCQ)]*
(d) Discuss the applications of collagen sponges in wound healing. *[(CO3)(Apply/IOCQ)]*

3 + 4 + 1 + 4 = 12

3. (a) What is a Collagen? What is the amino acid sequence of the collagen? *[(CO3)(Remember/LOCQ)]*
(b) Write notes on sterilization of biomaterials. *[(CO2)(Discuss/IOCQ)]*
(c) Illustrate the process of scaffold production for regenerating the tissues. *[(CO1)(Illustrate/IOCQ)]*

(2 + 1) + 5 + 4 = 12

Group - C

4. (a) Give some examples of hyaluronic acid's application for cancer treatment. *[(CO3)(Apply/HOCQ)]*
(b) Write some applications of chitin-based scaffolds in tissue engineering. *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

5. (a) Highlight on physical properties of chitin. *[(CO3)(Remember/LOCQ)]*
(b) Illustrate application of chitosan in drug delivery. *[(CO2)(Apply/IOCQ)]*

6 + 6 = 12

Group - D

6. (a) What do you mean by Bioplastics? *[(CO5)(Remember/LOCQ)]*
(b) Enumerate the properties of Polyhydroxybutyrate. *[(CO6)(Understand/IOCQ)]*
(c) Discuss the benefits of Hyaluronic acid in Joints. *[(CO4)(Apply/IOCQ)]*

3 + 4 + 5 = 12

7. (a) Illustrate the pathway of PHB degradation. *[(CO5)(Illustrate/HOCQ)]*
(b) Discuss the properties of Hyaluronic acid. *[(CO4)(Discuss/IOCQ)]*
(c) Enumerate the properties of Polylactic acid. *[(CO6)(Discuss/IOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) Differentiate: Linear and Branched Polymers with examples of each type. *[(CO6)(Analyse/HOCQ)]*
(b) How is Glass transition temperature related to structure of polymer? *[(CO6)(Analyse/IOCQ)]*
(c) Define % crystallinity of amorphous biomaterial. *[(CO6)(Remember/LOCQ)]*

6 + 4 + 2 = 12

9. Define the following terms in context to mechanical properties of biomaterial.
(i) yield strength
(ii) bulk modulus
(iii) modulus of elasticity
(iv) toughness of a material
(v) fracture strength
(vi) UTS. *[(CO6)(Define/LOCQ)]*

(6 × 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	45.8	37.5	16.66