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) Resilon is composed of
(a) PHB (b) Polylactic acid
(c) Polycaprolactone (d) Polyphenol.

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

(iii) Monocryl is composed of
(a) Caprolactone (b) Hyaluronic acid
(c) PHB (d) Polyphenol.

(iv) Dacron is a du Pont trade name for
(a) Pyrolytic carbon (b) Polyethylene terephthalate
(c) Platinum-iridium alloy (d) Nickel-titanium alloy.

(v) Enzymes catalysing the conversion of Aceto-acetyl CoA to 3-hydroxybuturyl CoA is
(a) Ketothiolase (b) Acetoacetyl CoA reductase
(c) PHB synthase (d) PHB Polymerase.

(vi) Which of the following proteins are present in cocoons of Bombyx mori?
(a) Fibroin and Keratin (b) Fibroin and Sericin
(c) Fibroin and Collagen (d) Sericin and Keratin.

(vii) BIOPOL is a co-polymer of
(a) PHB-PHO (b) PHB-PHV
(c) PHV-PHO (d) None of (a), (b) & (c).

(viii) Which of the following is a property of thermosetting plastics?
(a) Can be moulded (b) Soft
(c) Recyclable (d) Can be used at high temperatures.

(ix) Which of the following gel/hydrogel id formed by physical gelation mechanism?
(a) Polyester gel (b) Gelating
(c) CMC-g-acrylic ac (d) Poly-di-methyl siloxane.

(x) Ductile material has
(a) long elastic region (b) long plastic region
(c) elastic region absent (d) plastic region absent.

Fill in the blanks with the correct word

(xi) Nitinol is _____alloy.

(xii) The cross-linking between tropocollagen molecules is catalyzed by _____.

(xiii) _____is considered to be the lubricant of our body.

(xiv) Molecular weight of polymer divided by molecular weight of a monomer is known as _____.

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

Group - B

2. (a) Why do naturally derived biomaterials have been demonstrated to show several advantages compared to synthetic biomaterials? *[(CO1)(Analyze/LOCQ)]*
(b) Comment on different methods of sterilization for tissue regeneration. *[(CO2)(Comment/IOCQ)]*
(c) Illustrate the properties of silk fibroin. *[(CO3)(Illustrate/IOCQ)]*

2 + 5 + 5 = 12

3. (a) Briefly describe with a schematic diagram the processes of Silk fibroin extraction. *[(CO3)(Illustrate/HOCQ)]*
(b) Discuss the applications of silk fibroin in wound healing. *[(CO3)(Discuss/IOCQ)]*
(c) Controlled drug release is another biomaterial application that is receiving considerable attention - Explain. *[(CO1)(Comment/LOCQ)]*

5 + 4 + 3 = 12

Group - C

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

6 + 6 = 12

5. (a) Define hydrogel. *[(CO3)(Define/LOCQ)]*
(b) Describe the process of production of starch from potato. *[(CO4) (Discuss/IOCQ)]*

7 + 5 = 12

Group - D

6. (a) Comment on the applications of PHB. *[(CO5)(Comment/LOCQ)]*
   (b) Discuss the applications of hyaluronic acid in the tooth gums of the mammalian system. *[(CO5)(Discuss/IOCQ)]*
   (c) What do you mean by bioplastics? *[(CO5)(Remember/LOCQ)]*

5 + 5 + 2 = 12

7. (a) State the applications of poly-caprolactone. *[(CO5)(Remember/LOCQ)]*
   (b) Illustrate the production of poly-lactic acid. *[(CO5)(Illustrate/IOCQ)]*

6 + 6 = 12

Group - E

8. (a) Derive the relationship of % crystalinity of a polymer with the density of crystalline and amorphous region. *[(CO6)(Derive/HOCQ)]*
   (b) What are the methods of degradation of biomaterial? Explain the advantage of designing biomaterial to degrade through hydrolysis rather than biodegradation. *[(CO6)(Critical/HOCQ)]*

6 + 6 = 12

9. (a) Name two rheological models in relation with the properties of visco-elastic materials. Also state the assumptions of the models. *[(CO6)(Analyse/IOCQ)]*
   (b) Why is it necessary to examine the average molecular weight of polymeric biomaterial? Illustrate the ways to report average molecular weight of them. *[(CO5)(Understand/IOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	26.04	56.25	17.71

Course Outcome (CO):

After completing this course, students will be able to:
1. Explain the fundamentals of Biomaterials.
2. Apply the knowledge of sterilization of Biomaterials in tissue regeneration.
3. Illustrate the structure, production process and applications of protein based Biomaterials.
4. Describe structure, production process and applications of carbohydrate based Biomaterials.
5. Describe structure, production process and applications of industrially important Biomaterials.
6. Illustrate the properties of different Biomaterials.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*