BIOMATERIALS
(BIOT 4131)

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

(ii) Hyaluronic acid is composed of
(a) Glucuronic acid and N-acetylglucosamine (b) Polyglucuronic acid
(c) Lysine-glycine-proline (d) None of the above.

(iii) The secondary structure of Silk Fibroin is
(a) right handed helix (b) left handed helix
(c) β-sheet (d) none of the above.

(iv) Which of the following are Biomaterials?
(a) Metals (b) Ceramics
(c) Biopolymers (d) All of the above.

(v) Which of the following amino acids is most abundant in collagen fibers?
(a) Hydroxyproline (b) Proline
(c) Glycine (d) Lysine.

(vi) Which of the following is a characterisation 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 stress-strain curve.

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

(viii) The number of repeating units in a polymer is known as _____
(a) monomer (b) degree of polymerization
(c) molecule (d) chain.

(ix) Which of the following is not a property of thermoplastics?
(a) Recyclable (b) Soft and weak
(c) Easy to mold (d) Can be used at high temperatures.

(x) Specific heat of materials is expressed in terms of _____
(a) W/m K (b) J/K
(c) J/kg K (d) m^3/kg.

Group - B

2. (a) Comment on the bioreactors used in tissue engineering for cell proliferation on a scaffold. [(CO2)(Comment/HOCQ)]
(b) Examine the role of biomaterials as cardiac pacemaker. [(CO1)(Examine/LOCQ)]
(c) Design the working principle of Electro-spinning. [(CO3)(Design/IOCQ)]
5 + 3 + 4 = 12

3. (a) What do you mean by Dacron? [(CO1)(Remember/LOCQ)]
(b) Classify with examples the different Biomaterials. [(CO1)(Classify/IOCQ)]
(c) Examine the role of biomaterials as Tooth implant. [(CO1)(Examine/IOCQ)]
2 + 6 + 4 = 12

Group - C

4. (a) Explain with few examples of application of starch as biomaterial. [(CO4)(Understand/IOCQ)]
(b) Describe with flow diagram how chitin is extracted from crustacean cell. [(CO5)(Remember/LOCQ)]
6 + 6 = 12

5. (a) Illustrate with a flowsheet the preparation of agarose from seeweeds. [(CO4)(Illustrate/LOCQ)]
(b) Describe with a diagram the method of preparing intelligent food packaging based on seeweed based polysaccharide. [(CO4)(Analyze/IOCQ)]
6 + 6 = 12

Group - D

6. (a) Illustrate the pathway for the synthesis of BIOPOL. [(CO5)(Illustrate/HOCQ)]
(b) Write down the different methods of bacterial cell lysis for PHB extraction. [(CO5)(Remember/LOCQ)]
(c) Discuss the applications of hyaluronic acid in the eyes of mammalian system. [(CO5)(Discuss/IOCQ)]
5 + 3 + 4 = 12

7. (a) Design the pathway of industrial production of Hyaluronic acid from bacterial strains. [(CO4)(Design/HOCQ)]

(b) Illustrate the properties of Polycaprolactone. [(CO5)(Illustrate/IOCQ)]

7 + 5 = 12

Group - E

8. (a) A spherical biomaterial immersed in a body fluid experiences pressure of 0.1 GPa. Due to this, change in diameter of the material is 1% of initial. Calculate the Bulk Modulus. [(CO6) (Calculate/HOCQ)]

(b) How is Glass Transition Temperature (Tg) related to structure of polymer. [(CO6) (Illustrate/IOCQ)]

6 + (2 + 4) = 12

9. (a) State the difference of stress strain curve of metal and ceramics. [(CO6) (Remember/LOCQ)]

(b) A polyurethane tube is stretched at 20%. When the stress is released it recovered 50% of its strain after 2 hr.

(i) Determine the retardation time.

(ii) What will be the percentage strain recovery after 4 hrs? [(CO6)(Evaluate/HOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.08	42.71	30.21

Course Outcome (CO):

After the completion of the 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