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) BIOPOL is a co-polymer of
(a) PHB-PHO (b) PHB-PHV
(c) PHV-PHO (d) None of the above

(ii) 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

(iii) Enzymes catalysing the conversion of Acetyl CoA to aceto-acetyl CoA is
(a) Ketothiolase (b) Acetoacetyl CoA reductase
(c) PHB synthase (d) PHB Polymerase

(iv) 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

(v) Nitinol is
(a) *Pyrolytic carbon* (b) Polyethylene terephthalate
(c) Platinum-iridium alloy (d) Nickel-titanium alloy

(vi) Following property is unique to polymeric materials:
(a) Elasticity (b) Viscoelasticity
(c) Plasticity (d) Melting

(vii) Which of the following is a characterization technique used to measure the Ductility of a biomaterial?
(a) Calculations from strength test
(b) Single edge notched-beam Indirect measurement
(c) Indentation
(d) Cyclic stress test

(viii) Polydispersity index is defined as _____ where Mw and Mn are the weight average and number average molecular masses respectively.
(a) Mw x Mn (b) Mw/Mn
(c) Mn/Mw (d) Mw – Mn

(ix) The response of a material due to the function of heat is known as _____
(a) Mechanical property (b) Electrical property
(c) Chemical property (d) Thermal property

(x) _____ is a network of polymer chains that are hydrophilic.
(a) Hydrogel (b) Alginate
(c) Starch (d) Amylose

Group - B

2. (a) Describe with a schematic diagram the processes of Silk fibroin extraction. [(CO3)(Describe/IOCQ)]

(b) Discuss the applications of Fibroin as Scaffolds. [(CO3)(Analyse/IOCQ)]

6 + 6 = 12

3. (a) Comment on the following statement: "Controlled drug release is another biomaterial application that is receiving considerable attention." [(CO3)(Comment/HOCQ)]

(b) Give a brief outline of the application of fibroin as scaffolds. [(CO3) (Analyse/IOCQ)]

(c) What do you mean by Tissue Engineering Triad? [(CO3)(Remember/LOCQ)]

4 + 5 + 3 = 12

Group - C

4. (a) Define hydrogel. Why starch based hydrogels are more popular than synthetic polymers? [(CO4, CO5)(Analyse/IOCQ)]

(b) Discuss on extraction of chitin from any natural source of your choice. [(CO4,CO5)(Critique/HOCQ]

(c) Evaluate application of corn starch in medical field. [(CO4, CO5) (Understand/LOCQ)]

4 + 5 + 3 =12

5. (a) Evaluate the applications of chitin for drug delivery system. [(CO4, CO5) (Evaluate/IOCQ)]

(b) Enumerate the different physical forms of hyaluronic acid. [(CO4, CO5) (Understand/LOCQ)]

6 + 6 = 12

Group – D

6. (a) Determine the properties of Polyhydroxybutyrates (PHB)?[(CO5) (Apply/IOCQ)]

   (b) What do you mean by Bioplastics? Name some Bioplastics. [(CO5) (Remember/LOCQ)]

   (c) Illustrate the process of Lactic acid production. [(CO5) (Illustrate/IOCQ)]

4 + 4 + 4 = 12

7. (a) Comment on the factors affecting the PHB accumulation in the bacterial cells? [(CO5) (Comment/HOCQ)]

   (b) What is a Hyaluronic acid? [(CO4) (Understand/LOCQ)]

   (c) Discuss the applications of hyaluronic acid in the joints of mammalian system. [(CO4) (Analyze/IOCQ)]

4 + 2 + 6 = 12

Group - E

8. (a) Draw and explain true - stress vs strain graph of metals used as biomaterial. [(CO6)(Analyse/IOCQ)]

   (b) Define bulk density and Poisson's ratio of a biomaterial. [(CO6)(Remember/LOCQ)]

   (c) Illustrate the process of stress shielding by metal implant in the process wound healing. [(CO6)(Critique/HOCQ)]

5 + (2 + 2) + 3 = 12

9. (a) Enumerate the factors on which melting point of polymeric biomaterial depends. [(CO6)(Remember/LOCQ)]

   (b) Calculate the polydispersity index of a polymer sample with the following distribution

Average number of monomers	Number of chains
10	5
100	25
500	500
1000	3
5000	15
50000	2

[(CO6) (Critique/HOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	29%	41%	30%

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

Department & Section	Submission Link
BT	https://classroom.google.com/c/NDU0OTAyODgyNTA0/a/NDU0OTAyODgyNTIz/details