BIOMATERIALS (SEMESTER - 8)

CS/B.Tech(BT)/SEM-8/ID-814C/09

1\. ....
Signature of Invigilator

2\. ....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | | |

CS/B.Tech(BT)/SEM-8/ID-814C/09

ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL – 2009

BIOMATERIALS (SEMESTER - 8)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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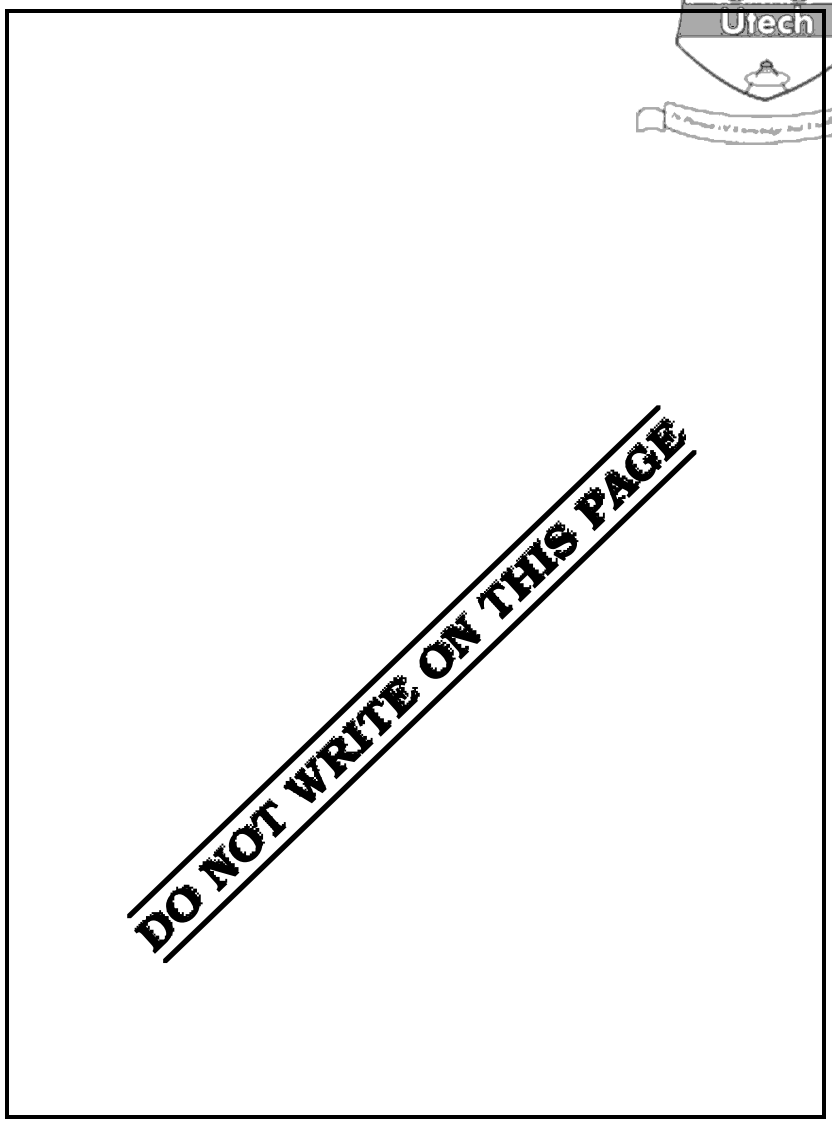
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

....
Head-Examiner/Co-Ordinator/Scrutineer

8884 C/E (27/04)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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Biomaterials are

a) natural polymer

b) synthetic polymer

c) both natural and synthetic polymer

d) biodegradable polymer. ☐

ii) Example of water soluble biopolymer is

a) starch b) gelatin

c) cellulose d) poly (glycolic acid) (PGA). ☐

iii) β (1 ∅ 4)-glycosidic linkages are found in

a) starch b) cellulose

c) gelatin d) collagen. ☐

iv) Which of the following carbohydrate acts as lubricant of synovial fluid and contributes to tensile strength and elasticity of cartilges and tendons ?

a) Hyaluronic acid b) Dextran

c) Glycogen d) Heparin. ☐

v) Polydextrose is a polymer of

a) *D*-glucose and sorbitol

b) *D*-glucose

c) *D*-glucose and citric acid

d) *D*-glucose, sorbitol and citric acid. ☐

vi) Heavy chains and light chains are joined together in silk protein fibroin by

a) covalent bonding b) disulfide bonding

c) H-bonding d) non-covalent bonding. ☐

vii) Poly-caprolactone is used in

a) cosmetics b) drug delivery device

c) wound care d) none of these. ☐

viii) Factors that accelerate polymer degradation

a) more hydrophilic backbones and end groups

b) less crystalline

c) more porosity

d) all of these. ☐

ix) *Leuconostoc mesenteroides* are involved the fermentative production of

a) biopol b) collagen

c) dextran d) PLA. ☐

x) Repeat sequence of amino acids observed in collagen

a) Ala-Pro-Hypro b) Gly-Pro-Hypro

c) Gly-Ala-Ser d) Ala-Ser-Pro. ☐

xi) Zein, a plant protein derived from

a) rice b) wheat

c) maize d) barley. ☐

xii) Fibroin is rich in

a) alanine, valine and proline

b) alanine, glutamic acid and aspartic acid

c) glutamic acid, glycine and proline

d) glycine, alanine and serine. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Name the protein present in silkworm silk. Discuss the physical properties of the protein with respect to its amino acid composition and structure. 1 + 4

3. How is dextran produced by microbial fermentation ? What are the commercial applications of the product ? 3 + 2

4. Which enzyme is required for conversion of guar gum to gel-forming polysaccharide ? How is it formed ? 1 + 4

5. What are two phases in Biopol production ? State the role of propionic acid in Biopol production. 2 + 3

6. What are polyphenols ? How can they be produced by enzymatic method ? 1 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Name two modified amino acid residues found in collagen. Discuss their role in maintaining the structure of collagen.

   b) Name an organism that can be used for production of human recombinant collagen (rhC). Discuss the major problems for production of rhC. 2 + 8 + 1 + 4

8. a) Why is a polymer called isoelastic ? How do you model an isoelastic polymer in terms of Maxwell's elements ?

   b) Draw a stress-strain diagram for different polymers like perfectly elastic, plastic and rubbery with charcteristic features.

   c) What is the effect of temperature on the modulus of a polymer (10^9 G Pa at room temperature) for low-molecular weight, crystalline and highly cross-linked polymers. 2 + 5 + 5 + 3

9. a) The following data were obtained for a polymethacrylate (monomer is $H_2C = CHCOOCH_3$) :

Mean weight (g/mol)	40,000	80,000	60,000
Weight (g)	2·0	1·0	1·0
Number fraction	0·5	0·4	0·1

   i) Calculate number average molecular weight (Mn) weight average molecular weight (Mw) of the polymer.

   ii) What is the polydispersity index of the polymer ?

   iii) Explain the sustainability of the material to be used as a prosthetic from the value of polydispersity index calculated.

   b) What is the glass transition temperature of a polymer ? How does it vary with the molecular weight of the polymer ? What is the significance of Tg in polymer processing ? (3 + 3 + 4) + 5

10. a) What is hyaluronic acid ? What are the different properties of hyaluronic acid that are important for mammalian system ?

b) Elaborate some medical and cosmetic applications of hyaluronic acid. (3 + 4) + 8

11. a) Briefly describe the pathway involved in the microbial biosynthesis of polyhydroxybutyrate (PHB).

b) What are the culture conditions that favour the increased production of PHB ?

c) Which is more advantageous for industrial application-Biopol or PHB ? Explain.

8 + 4 + 3

END