Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (BME)/SEM-4/BME-401/2011

2011
BIOMATERIALS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) The number of Bravias lattice is

      a) 7 b) 14

      c) 21 d) 28.

   ii) Alumina is a

      a) Inert Ceramics

      b) Bioactive ceramics

      c) Bioresorbable ceramics

      d) None of these.

iii) Creep is

a) Permanent deformation of material as a function of time

b) Permanent deformation of material irrespective of time

c) Viscoelastic deformation of material as a function of time

d) Elastic deformation of material as a function of time.

iv) Resorbable suture is made from

a) silicone rubber

b) nylon

c) polylactic acid

d) polyvinyl chloride.

v) Carbon content of 316L SS is

a) 0·08% b) 0·03%

c) 2% d) 18%.

vi) The first phenomena during blood-material interaction is

a) platelet interaction

b) albumin adsorption

c) intrinsic coagulation

d) fibrinogen polymerization.

vii) Fretting is associated with

a) corrosion b) dissolution

c) absorption d) solution.

viii) Elastin is a

a) carbohydrate b) protein

c) polysaccharide d) fat.

ix) Crystal structure means

a) random alignment of unit cells

b) periodic alignment of unit cells

c) ductile material

d) brittle material.

x) Collagen is a

a) natural polymer

b) synthetic polymer

c) semi-synthetic polymer

d) protein.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define biomaterials. Classify biomaterials with examples. What are the basic criteria for biomaterials ? $1+1\frac{1}{2}+2\frac{1}{2}$

3. Define the term "bioceramics" and classify with appropriate examples. What are glass ceramics and pyrolytic carbon ? 3 + 2

4. What is stress corrosion cracking ? How can it be prevented ? $2\frac{1}{2}+2\frac{1}{2}$

5. What are the effects of host on the implant material when it is implanted in the body ? 5

6. What do you mean by passivation ? What are the factors influencing corrosion reaction ? 5

7. What are the different fracture fixation devices ? 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. Define biomaterials. What are the basic criteria of biomaterials ? Why ceramic materials cannot be used for load bearing application ? Define fracture toughness and impact strength. $2 + 5 + 3 + 2\frac{1}{2} + 2\frac{1}{2}$

9. a) Describe the Maxwell model for viscoelastic materials.

   b) A stress of 1 MPa was required to stretch a 2 cm aorta strip to 2·3 cm. After an hour in the same stretched position, the strip exerted a stress of 0·75 MPa. Assume the mechanical property of the aorta did not vary appreciably during the experiment.

      i) What is the relaxation time, assuming a simple exponential decay model ?

      ii) What stress would be exerted by the aorta strip in the same stretched position after five hours ? $8 + 7$

10. a) What do you mean by creep ? Define the term viscoelastic deformation and elastic deformation of materials.

    b) Briefly describe the wound healing response after biomaterial implantation in body.

    c) What is degree of polymerization ? (2 + 2 + 2) + 7+ 2

11. a) What are the applications of alumina and carbon in medical field ?

    b) Briefly discuss about the different sterilization techniques for sterilization of biomaterials.

    c) Describe the effects of sterilization on the properties of biomaterials. (2 + 2) + 6 + 5

12. Describe the effect of physiological fluid on the properties of biomaterials. Explain the mechanical properties of biomaterials and mention their importance for designing implant. 7 + 8

13. Write short notes on any *three* of the following : 3 × 5

a) Artificial heart valve

b) Toxicity testing

c) Mutagenicity testing

d) Polymers in controlled release system

e) Dental implant.