

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 : $10 \times 1 = 10$

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

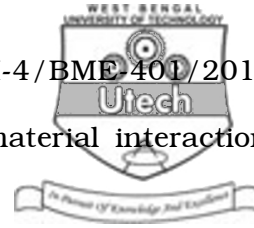
- a) Permanent deformation of material as a function of time
- b) Permanent deformation of material irrespective of time
- c) Viscoelastic deformation of material as a function of time
- d) Elastic deformation of material as a function of time.

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)

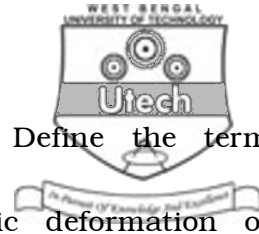
Answer any *three* of the following. $3 \times 15 = 45$

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.

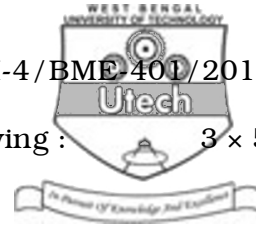
$$2 + 5 + 3 + 2\frac{1}{2} + 2\frac{1}{2}$$

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.
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