Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CT)/SEM-7/CT-703A/2010-11

2010-11

BIOCERAMICS

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) Which of the following components cannot used as biomaterial ?

      a) Alumina-Zirconia composite

      b) Calcium phosphate

      c) Calcium sulphate

      d) Magnesium silicate.

   ii) Bone is specially vulnerable to fracture in older people because

      a) less of bone density and strength with age

      b) high work load at older age

      c) tension related job

      d) food habit.

iii) Which of the following glasses is a bioactive glass ?

a) $Na_2O - Al_2O_3 - SiO_2$ glass

b) $Na_2O - CaO - P_2O_5 - SiO_2$ glass

c) $Na_2O - B_2O_3 - SiO_2$ glass

d) $Na_2O - CaO - SiO_2$ glass.

iv) Which joint does not allow any movement ?

a) spine joint

b) joints at jaws

c) hip joint

d) skull joints.

v) The superb tribiological property of alumina occurs only when

a) grains are very small with narrow size distribution

b) high surface roughness

c) large grains with narrow size distribution

d) highly porous.

vi) Which of the following is/are bioinert material/s ?

a) Carbon b) Calcium phosphate

c) 45S5 bioglass d) A/W glass ceramics.

vii) The function of ligament is to

a) attach muscles to bones & other parts

b) tie two bones together at a joint

c) absorb shock by cushioning

d) allow body movement.

viii) Which statement is *not true* ?

a) Bio-ceramics material should be biocompatible

b) Total joint replacement by bioceramics can survive for 20-25 years

c) Alumina based bioceramics can dissolve & be replaced by bone growth

d) Hydroxy carbonate apatite (HCA) layer is formed on bioactive implants at the interface.

ix) For type 2 porous implants, the pore size is to be

a) in the range 10 μm to 50 μm

b) in the range 100 μm to 150 μm

c) in the range 150 μm to 200 μm

d) in the range 50 μm to 100 μm.

x) Clinical success is achieved in Type I bioceramic implants when

a) movement at biomaterial tissue interface occurs

b) thickness of non-adherent fibrous capsule is 100 μm

c) if implanted bio-ceramics are very tight mechanically fitted and under compression

d) If bone cement is used to fit the implant.

GROUP – B

(Short Answer Type Questions)

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

2. Define biocompatibility and biofunctionality. What is osteoporosis ? 4 + 1

3. How does bioactive glass differ from common glass ? What does 45 S 5 signify ? 3 + 2

4. Draw the effect of age on the strength of bone and probability of fracture. What type of harsh environment and mechanical stresses are faced by implants within human body. 3 + 2

5. Define bio-material with example. What are implants & grafts ? Give examples. 3 + 2

6. Briefly state the prerequisite for any synthetic material to be implanted in a human body.

GROUP – C

(Long Answer Type Questions)

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

7. State the different types of implant-tissue response. Briefly describe the different types of bioceramic-tissue attachment & bioceramic classification with examples. How type 2 implants work at the tissue-implant interface ? What are the limitations of this type 2 implants ? State the different applications of bioceramics in human body.

$3 + 4 + 3 + 2\frac{1}{2} + 2\frac{1}{2}$

8. Discuss the stability of different phases of calcium phosphate at body temperature in contact with aqueous media. Briefly describe the synthesis of hydroxy apatite. How does hydroxy apatite work at the tissue-implant interface ? State mechanical mechanism of calcium phosphate.

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

9. Why alumina has been used in orthopaedic surgery for last 30 years ? How do texture and grain size control the properties of alumina implants ? Briefly state the preparation of alumina to be used for implants. Why is alumina ball & socket pair preferred to metal polyethlene ? $3 + 4 + 6 + 2$

10. What is bioactive glass ? Briefly describe the different reaction stages of a bioactive glass-tissue interface ? How are bioactive glass/glass-ceramics manufactured ? Name three bioactive glass/glass-ceramics with their applications.

11. Write short notes on any *five* of the following : 5 × 3

a) Resorbable bioactive materials — complications

b) Chemical vapour deposition

c) Cold isostatic pressing (wet bag)

d) Composition/constituents of human bone

e) Carbon as bioceramic material

f) Type 3 bioceramic materials

g) Porosity in bioceramic materials.