Uva Wellassa University, Sri Lanka

Faculty of Science & Technology

Science & Technology Degree Program

Year IV Semester I

End semester Examination February/March 2012

SCT 456-2 Composites and Bio materials

Instructions to candidates
This paper consist of Part A and Part B
Answer two (02) questions from Part A and all the questions in Part B
All questions carry equal marks
Total questions : 05
Total marks allotted : 100
Time : Two (02) hours

PART A (Answer 02 questions only)

1).

a. What are the three main categories of composites?

b. The properties of a composite are mainly determined by three main parameters. What are these parameters?

c. What does it mean by *dispersed phase geometry* in composite technology?

d. Based on the particle-matrix interactions, distinguish the difference between *large particle-reinforced composites* and the *dispersion-strengthened composites.*

e. State the *rule of mixtures* equations (*upper bound* and *lower bound*), which are developed to predict the elastic modulus of a composite. A new particle reinforced composite is prepared by replacing 29% of the volume of a soft metal by fine particles of a hard ceramic. If the moduli of elasticity of the metal and the ceramic are 398 and 615 GPa, respectively, compute the modulus of elasticity of this new composite.

2).

a. What are the three main groups of fibers categorized based on their diameter and character?

b. Make a rough sketch to show the *stress-position profile* of a fiber. Note that the length (l) of this fiber is greater than its critical length (l_c), that is $l > l_c$. Moreover the fiber is subjected to a tensile stress equal to its tensile strength (σ^*_f).

c. With this sketch in part ii., explain how the fiber reinforcement becomes more effective when $l > l_c$.

d. Briefly describe a major role of the *matrix phase* in a fiber-reinforced composite.

e. List four advantages of glass fibers as a reinforcing medium in composites.

3).

a. What are *cermets?*

b. Briefly explain the role of each material component used to prepare *reinforced concretes.*

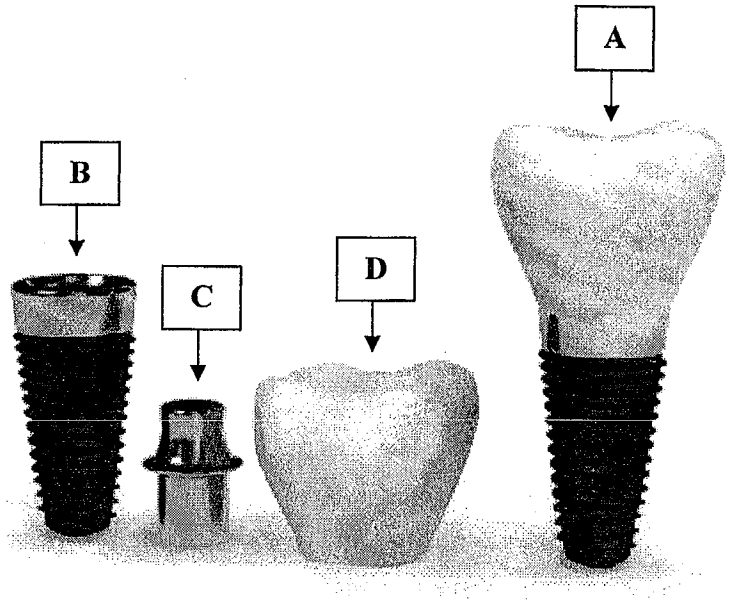
c. Give two strong reasons for selecting steel to reinforce concretes.

d. With the help of a schematic representation, briefly explain the *transformation toughening of* ceramics using ZrO_2 particles.

e. What is the main structural difference between *laminar composites* and *sandwich panels?*

PART B (Answer both questions)

4)



a. Name A, *B*, *C* and *D* of the above Diagram

b. Name the most commonly used materials to fabricate *A*, *B*, *C* and *D*

c. What are the considerations when selecting materials for fabricating *A*?

d. Materials selected for *A* should be able to withstand drastic temperature and pH changes. Briefly explain why.

e. Very briefly give the sequential surgical process of implanting *A* in human body

5)

a. What is a biocompatible material?

b. What are the features of biocompatible materials?

c. Briefly discuss the use and advantages of biodegradable implants. Give examples whenever neccessory.

d. What are the problems assorciated with long term use of permanent implants?