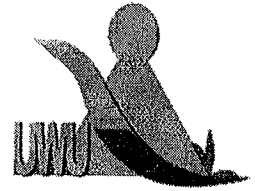


Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Science and Technology Degree Programme
2nd Semester Examination –September/October 2013
SCT 446-2 Composites and Biomaterials



Total number of questions four (04)
Answer all the questions
Total time allocated: Two (02) hours
Total marks allocated: 100

1.
 - a. Define the term *composite*.
 - b. Briefly explain the difference between the *large-particle composites* and the *dispersion-strengthened composites*.
 - c. State the *rule of mixtures equations* (upper bound and lower bound), which are used to estimate the elastic modulus of a large particle reinforced composite.
 - d. By clearly showing the *upper bound limit* and the *lower bound limit*, make a rough sketch to show the *dependence of elastic modulus on the volume fraction of the dispersion phase*.
 - e. List the three main factors on which the properties of a structural composite depend on.
(25 marks)

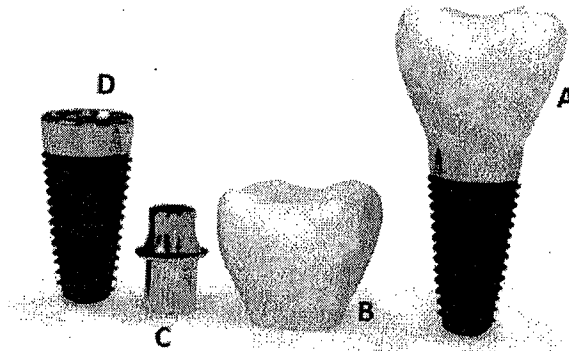
2.
 - a. State the expression relating the *critical length* (l_c) with the *fiber diameter*, its *ultimate (or tensile) strength* and the *fiber-matrix bond strength* for a fiber reinforced composite. A fiber with an average diameter of 2.0×10^{-5} m and a tensile strength of 3×10^8 Pa is used to fabricate a fiber reinforced composite. If the fiber-matrix bond strength is 1.5×10^6 Pa, calculate the critical length (l_c).
 - b. Make a rough sketch to show the *stress-position profile* when the used fiber length is greater than the critical length (l_c), for a fiber-reinforced composite that is subjected to a tensile stress equal to the tensile strength of the fiber.
 - c. What are the three main tasks expecting from the matrix phase in a fiber-reinforced composite?
 - d. Briefly explain why the composite failure is not a catastrophic.
 - e. Give three strong reasons for using glass fibers as a reinforcement material in composites.
(25 marks)

3.

- a. Materials in total dental implants should be able to resist drastic temperature and pH changes in the oral cavity. Discuss this statement.

(05 marks)

- b. Given in the Figure below labeled as *A* is a total dental implant.



- i. Name parts *B*, *C* and *D*
- ii. Suggest materials to manufacture parts *B* and *D*
- iii. Briefly explain all the surgical steps involved in planting *A* in the oral cavity

(15 marks)

- c. Discuss advantages and disadvantages of using resin in tooth fillings.

(05 marks)

4.

- d. List the main material attributes for biomedical applications.

(05 marks)

- e. What do you mean by “biocompatibility”?

(05 marks)

- f. What are the features of biocompatible materials?

(05 marks)

- g. Briefly discuss the advantages of “biodegradable” implants.

(10 marks)