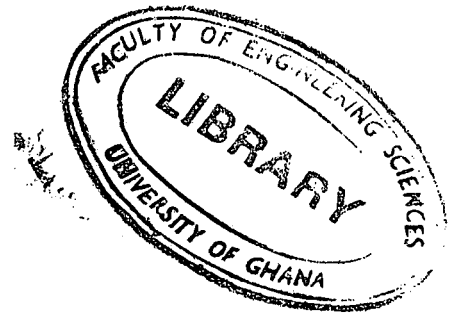




University of Ghana  
(All rights reserved)



*first* BSc. Biomedical Engineering  
Second semester examinations: 2015/2016  
Department of Biomedical Engineering  
BMEN 305: Biomaterials (3 credits)

Answer all questions

Time:  $2\frac{1}{2}$  hours      Total Marks: 100

1. Explain stress shielding and relate it to biomaterial design. (5 marks)
2. In fabricating metallic implants for load bearing application, microstructure has influence on the physical and mechanical properties. Figure 1 is a micrograph of stainless steel. The surface is made up of mixture of phases (austenite and ferrite) and pits.
  - i. Indicate which of the phases A or B is preferable for implant application. Give two reasons for your choice. (10 marks)
  - ii. Explain what causes the pits in Figure 1. How do the pits affect the implant? Explain any two adverse local tissue responses that may be triggered as a result of development of the pits. (15 marks)
  - iii. The two phases A and B are welded in figure 2. Explain what phase is forming in C and explain why stainless steels are not welded for implant application. How is 316L stainless steel fabricated for implant application? (10 marks)

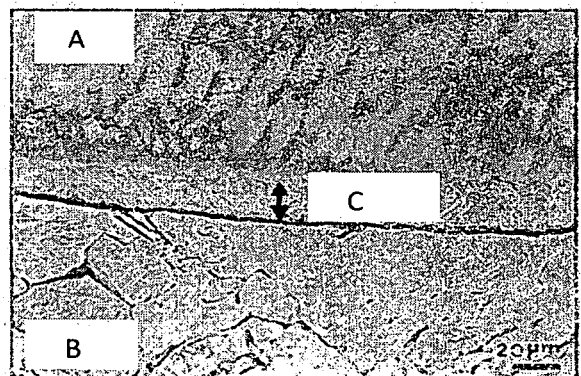
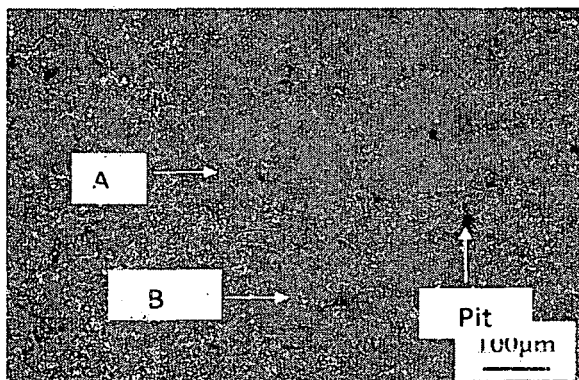


Figure 1 surface of stainless steel, made of mix phases and pits Figure 2 welded surface of three phases A, B and C

3. (a) The technique used to fabricate bioceramic devices will depend greatly on the ultimate application of the device, whether it is for hard tissue replacement or the integration of the device within the surrounding tissue. Explain the principle which will be adopted in fabricating these bioceramics for:
- Hard tissue replacement and
  - Tissue integration
- (b) State any one method each for achieving (a) i and ii (15 marks)
4. (a) Explain the general mechanism of biodegradation and give three reasons why tailor made biopolymers are preferred to natural ones. (10 marks)
- b) Describe with illustration the difference between surface erosion and bulk erosion. Give two reasons why surface erosion will be preferable to bulk erosion for biopolymer implants. (10 marks)
- c) Explain any three factors that affect degradation and outline any three analytical techniques of monitoring biodegradation of polymers. (10 marks)
5. (a) Collagen and chitosan are natural polymers used as biomaterials. Give two locations where collagen is located in the human body. From which sources are collagen and chitosan obtained for medical use? Name one application each for collagen and chitosan. (7 marks)
- (b) Discuss two future trends in the development of implantable biomaterials. (8 marks)

