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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017**

COURSE NAME : BIOMATERIALS
COURSE CODE : BEU 41103
PROGRAMME : BEJ
EXAMINATION DATE : JUNE 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1**
- (a) Describe the **TWO (2)** difference between soft and hard tissues.
(4 marks)
 - (b) Apply an appropriate method to assess the biocompatibility of an artificial hip implant.
(4 marks)
 - (c) You are evaluating a synthetic bone graft. Following the implantation of the bone graft in a mice, the scanning electron microscopy (SEM) indicated detachment of tissue from the bone graft. Deduce **FOUR (4)** reasons that the failure of tissue adhered to the bone graft.
(8 marks)
 - (d) Most tissue in the body are relatively soft compared to bone. Explain the function of high modulus bone. State the considerations of the modulus in designing a synthetic scaffold material to replace bone via tissue engineering approach.
(4 marks)



- Q2**
- (a) Fill in the Table **Q2(a)** regarding the four levels of protein structure (from the least to the most complex or going from top to bottom). One box has been filled in for you.
(6 marks)
 - (b) Explain **TWO (2)** chemical interactions occur between amino acids to determine the secondary and quaternary structure levels listed in Table **Q2(a)**.
(4 marks)
 - (c) A cell was found attaching to substrate coated with laminin coating.
 - (i) Draw the structures of cell adhesion to this specific extracellular matrix (ECM) protein.
(4 marks)
 - (ii) Deduce and explain the macromolecules involved with the cell adhesion and anchorage to the ECM proteins.
(6 marks)

- Q3 (a)** Synthetic bio-inert materials are currently used as an alternative to autogenous bone graft. Calcium hydroxyapatite (HA) and Beta tri-calcium phosphate (β -TCP), which belong to the calcium phosphate ceramics group, are biocompatible and osteo-conductive of cells. Suggest and explain **FOUR (4)** methods to assess the mechanical and physical properties of a biocomposite that were enhanced with HA and TCP. In your description, please include drawings to describe the test.

(8 marks)

- (b) After examining the mechanical/physical properties and you would like to examine the surface properties of the TiO_2 coating, suggest **FOUR (4)** suitable methods that can be used to study the surface properties of the coating. Explain the expected outcomes for each of the suggested methods of measurement. In your description, please include drawings to describe the test.

(12 marks)

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- Q4** Figure Q4(a) shows the photomicrographs of Field Emission-Scanning Electron Microscopy of Hydroxyapatite coating (HA) formed on Ti-Alloy at different calcination temperatures.

- (a) Evaluate and compare the structure produced for the HA and the structural organisation of bone in the cortical bone. Your explanation should be included drawings.

(6 marks)

- (b) Comment whether this structure is suitable to be applied as artificial bone interface.

(4 marks)

- (c) Deduce the potential problem that could happen when this morphology of HA is used as implants. You may explain the potential problem with inclusion of drawings.

(4 marks)

- (d) Suggest suitable structures of the bone graft and give reasons that could help to ensure the success in making this coating as interface to tissues in the bone.

(6 marks)

Q5 In your research lab, you are required to design an artificial skin graft that can be used for replacement of burned skin. Chitosan is an extract from the shrimp and other crustacean shells, and it has been incorporated into many new hydrogels design.

(a) Give **TWO (2)** advantages and disadvantages of Chitosan in the design of the biomaterial.

(4 marks)

(b) The mechanical properties are important to ensure that the cells are adaptable to the stiffness of the material and restructure themselves accordingly. Suggest and explain **TWO (2)** techniques that could be used to assess the **TWO (2)** physical properties of a chitosan doped PEG.

(6 marks)

(c) Deduce the expected Young's modulus and stress-strain response of the chitosan hydrogel.

(4 marks)

(d) A sensor with the chitosan coating was implanted directly in the grey matter of the brain produce the highest quality signals, however, some complications build up and causing the signal to become weaker or non-existent as the body reacts to a foreign object in the brain. Analyse this situation and state the **THREE (3)** possible reasons that caused the loss of signals.

(6 marks)

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- END OF QUESTIONS -

FINAL EXAMINATIONSEMESTER/SESSION : SEM II/2016/7
COURSE NAME : BIOMATERIALSPROGRAMME : 4 BEJ
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Structure level	Structure/conformation determined by:
Primary (1 ^o)	
Secondary (2 ^o)	Interactions between amino acids of relatively close proximity to one another on a polypeptide chain
Tertiary (3 ^o)	
Quaternary (4 ^o)	

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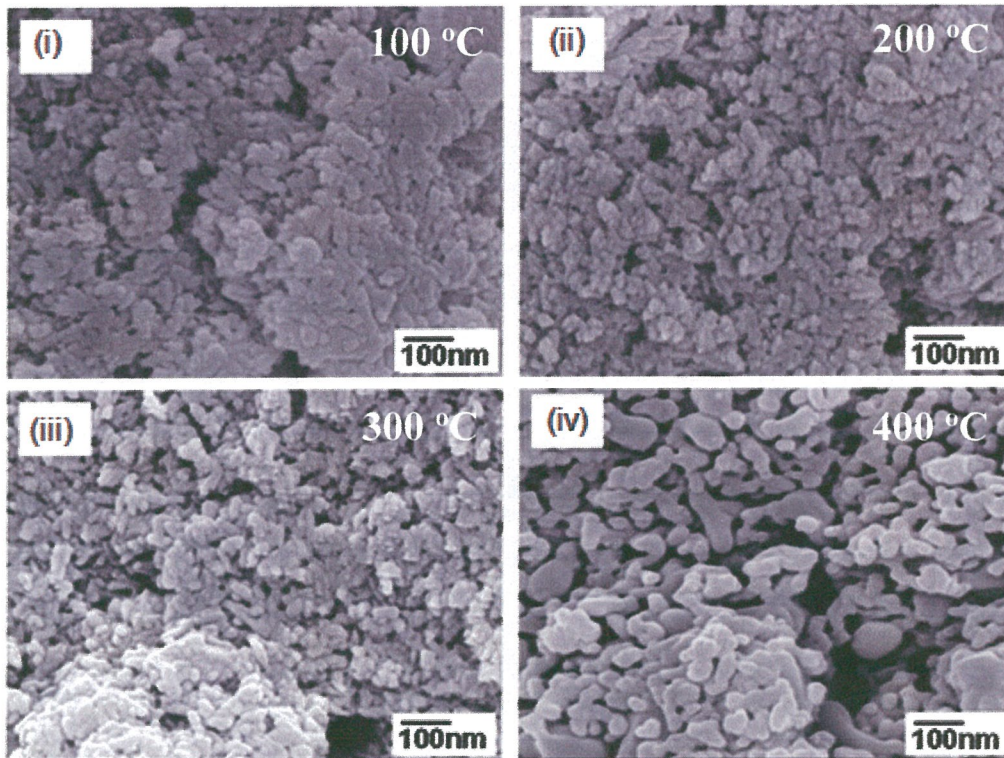


Figure Q4(a)

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