

**CONFIDENTIAL**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2013/2014**

COURSE NAME : BIOMATERIALS  
COURSE CODE : BEU 41103  
PROGRAMME : 4 BEJ  
EXAMINATION DATE : JUNE 2014  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER FIVE (5) QUESTIONS  
ONLY

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

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- Q1**
- (a) Sketch and describe the organization of a skin histological section. (4 marks)
  - (b) Organs are made up of tissues, typically with one dominant tissue type and the other for supporting functions. Explain the functions of these tissues. (6 marks)
  - (c) Explain the molecular structure of Glycoaminoglycan and the function of this protein. (6 marks)
  - (d) Compare the differences between Xenograft and Allograft. (4 marks)
- Q2**
- The protocol for analyzing two dimensional (2D) cell culture is very common but three dimensional (3D) cell culture is the current research trend. In your research lab, 3D microtissues of epithelial cells of size ranging from 200 - 300 micrometre were synthesized using a novel method.
- (a) Suggest and describe the protocols that could be applied to evaluate the biological relevance of the microtissues. (10 marks)
  - (b) Illustrate **FOUR** (4) potential applications of this type of microtissues. (4 marks)
  - (c) Design a protocol that will be used to examine the histological section of the microtissue. (6 marks)
- Q3**
- (a) A new biomaterial with a porosity of 50% has been synthesized with the contents as shown in Table **Q3 (a)**. Evaluate the contents and suggest which part of the physiological system can be substituted by this biomaterial. Explain the reasons for your suggestion. (4 marks)
  - (b) Develop an experiment protocol that a biomaterials scientist can measure the contact angles of a surface and relate that to a surface property for analyzing a surface. (6 marks)
  - (c) Figure **Q3 (c)** is the chemical structure of amoxicillin. Analyze and list out the four functional groups in amoxicillin. (4 marks)

- (d) Differential scanning calorimetry (DSC) is a useful tool in studying the thermal activity of a biomaterial. A hydrogel has strong endothermic activity at 50 °C for three repeat of experiments as show in Figure **Q3(d)**. Relate the thermal response of the hydrogel to the suitability as a biomaterial.  
(6 marks)
- Q4** (a) How does the density of a given synthetic biomaterial affect the decision of producing an implant out of it?  
(2 marks)
- (b) Figure **Q4 (b)** shows the stress-strain diagram of biomaterial A, B and C. Compare the three materials and explain which material is most suitable to be applied as soft implant.  
(4 marks)
- (c) Figure **Q4 (c)** shows the result of the frequency sweep test at 5% strain of a new polymer for four repeat of experiments. Evaluate the graph if the polymer is applicable as a artificial skin graft.  
(8 marks)
- (d) Recommend a material which is suitable to replace cartilage at the knee cap and justify how you determine the biocompatibility of this material.  
(6 marks)
- Q5** (a) Explain the processes involve to enable the cells to attach to a biosurface of an implant.  
(6 marks)
- (b) Explain how the charges of the adhesion proteins in influencing the adhesion to a biosurface. Suggest amino acids that are positive charge and show affinity to a negatively charged surface.  
(4 marks)
- (c) Given an example of a biopolymer and a synthetic polymer. Distinguish **TWO** (2) differences between a biopolymer and a synthetic polymer that you have suggested.  
(6 marks)
- (d) Polymethylmethacrylate (PMMA) is a polymeric substance which is the main ingredient in a number of polymer-based bone cements used in fixing or glueing (by an orthopedic surgery) titanium alloy implants to the

hard tissues. Recommend and explain briefly methods used to evaluate the “bone-bonding ability” of a bioinert implant material.

(4 marks)

- Q6**
- (a) Explain if the “ideal” biomaterial is always chemically inert. (2 marks)
  - (b) A patient complaint about itchness, swells and redness of skin after application of a new topical cream. Evaluate this problem and suggest the reasons for this symptom. (4 marks)
  - (c) State **THREE** (3) differences between acute and chronic inflammation. (6 marks)
  - (d) List **FOUR** (4) features of implant associated with infections and recommend strategies that can used to decrease or prevent implant-associated infections. (4 marks)
  - (e) Explain the causes of restenosis when vacular stent is implanted and the effects of the restenosis to the physiological system. (4 marks)

**- END OF QUESTION -**

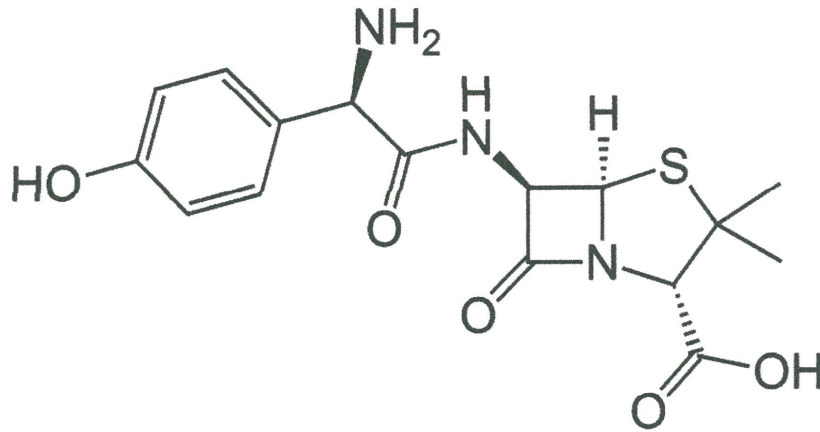
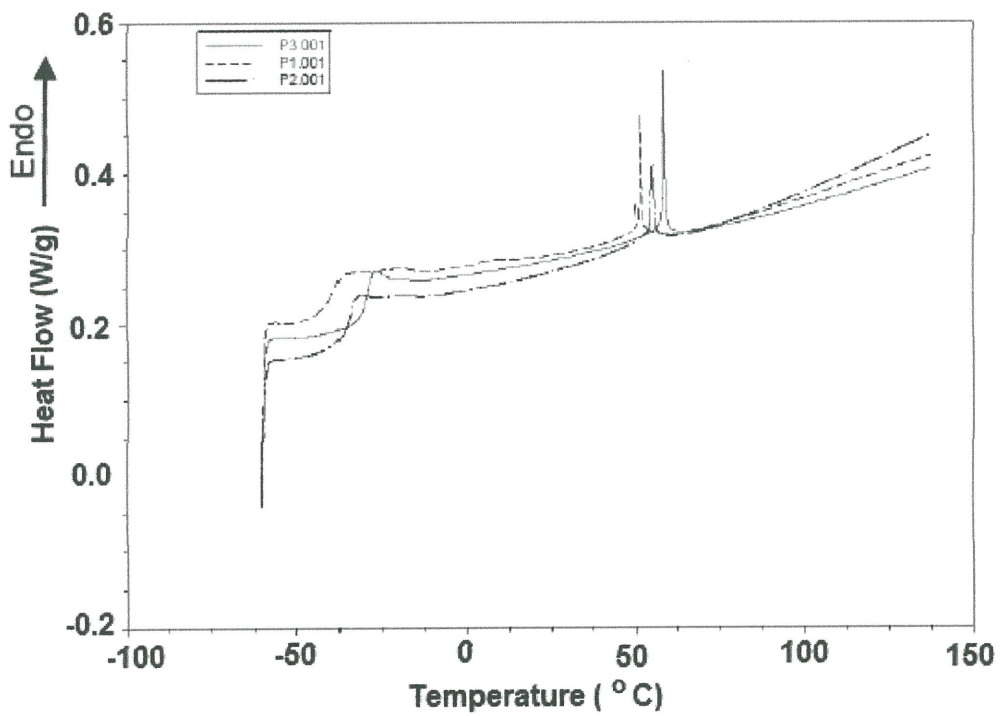
**FINAL EXAMINATION**

SEMESTER/SESSION: SEM II/2013/2014  
COURSE NAME : BIOMATERIALS

PROGRAMME : 4 BEJ  
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**TABLE Q3 (a)**

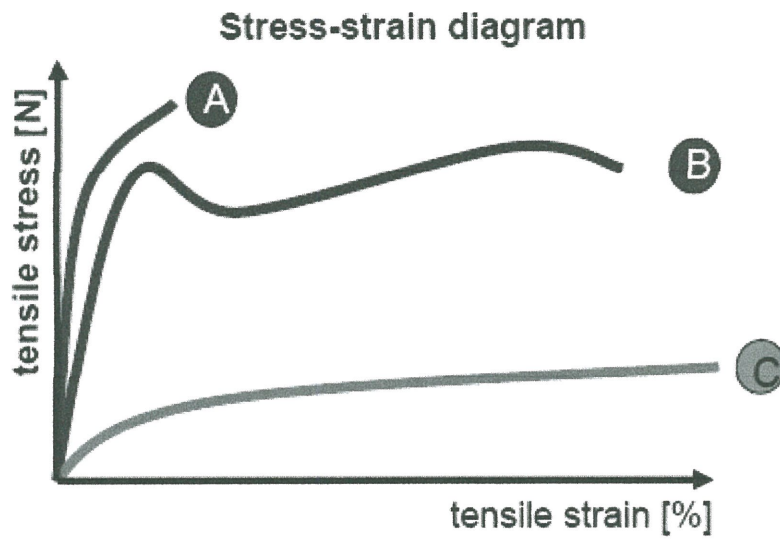
<b>Contents</b>	<b>Percentage</b>
Contain collagen Type I	14%
Hydroapatite	50%
Ground substance	3%
Water	19%

**FINAL EXAMINATION**SEMESTER/SESSION: SEM II/2013/2014  
COURSE NAME : BIOMATERIALSPROGRAMME : 4 BEJ  
COURSE CODE: BEU 41103**FIGURE Q3(c)****FIGURE Q3(d)**

**FINAL EXAMINATION**

SEMESTER/SESSION: SEM II/2013/2014  
COURSE NAME : BIOMATERIALS

PROGRAMME : 4 BEJ  
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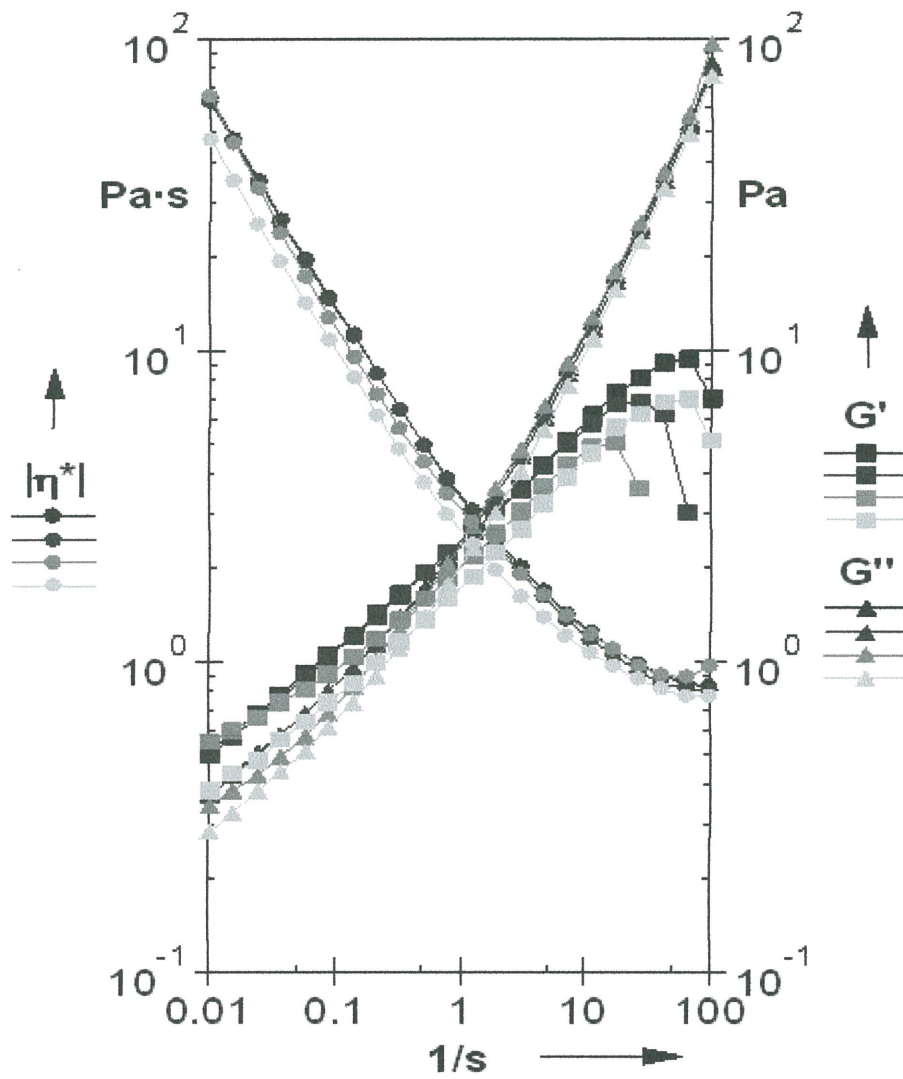


**FIGURE Q4 (b)**

**FINAL EXAMINATION**

SEMESTER/SESSION: SEM II/2013/2014  
 COURSE NAME : BIOMATERIALS

PROGRAMME : 4 BEJ  
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**FIGURE Q4 (c)**