



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

- COURSE NAME : BIOMATERIAL
- COURSE CODE : BEJ 45603 / BEU 41103
- PROGRAMME CODE : BEJ
- EXAMINATION DATE : JULY / AUGUST 2023
- DURATION : 3 HOURS
- INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

- Q1** **Figure Q1(a)** shows the Hoechst & Eosin histological stain of an unknown tissue.
- (a) Identify parts A, B and C of the tissue as shown in **Figure Q1(a)**.
(6 marks)
- (b) Explain the function of the cells and tissue microstructure identified for parts A, B and C in **Figure Q1(a)**.
(12 marks)
- (c) Explain a biomaterial that is suitable to fabricate an artificial tissue to repair this tissue found in **Figure Q1(a)**.
(2 marks)
- Q2** (a) Examples of synthetic biopolymers are polyglycolic acid (PGA) and polycaprolactone (PCL). Distinguish **THREE (3)** advantages and disadvantages of applying them as biomaterials.
(6 marks)
- (b) Fibronectin existence is highly abundant in human body.
- (i) Define fibronectin and its properties.
(2 marks)
- (ii) Identify **TWO (2)** types of fibronectins available.
(3 marks)
- (iii) Suggest the protein molecules of the fibronectin which mediate cell binding.
(2 marks)
- (iv) Analyze and justify the involvement of fibronectin in wound healing.
(3 marks)
- (v) The cells with their integrin proteins specific to fibronectin binding were inhibited. Deduce the consequences of this inhibition.
(4 marks)

- Q3** (a) ISO 10993-1:2018 contains the procedures suggested for the biological evaluation of medical devices. In designing a medical device, the choice of low-quality material with respect to its biocompatibility might result in a less functional medical device, biocompatibility being only one of a number of characteristics to be considered in making that choice. Where a material is intended to interact with tissue in order to perform its function, biological evaluation needs to be addressed. Propose **TWO (2)** in-vitro techniques that can be performed to evaluate the cytotoxicity of the implant.
- (6 marks)
- (b) Biopolymer is an important example of biomaterials safe to be used in various applications such as implants and coatings. Give **TWO (2)** specific applications of biopolymer as biomaterials and justify **TWO (2)** reasons for each polymer suggested for the applications.
- (6 marks)
- (c) In the cardiology department, a new batch of Drug Eluting Stent (DES) was purchased for patients with coronary artery disease. After the angioplasty procedure, the patient complained of heartache and failure in wound healing at the stent implant site. Perioperative complications and a thrombosis incidence were found at the stent implant site. The wire mesh of the stent was removed, and a new stent was replaced for the patient. Coating delamination was found on the wire mesh. As a biomedical engineer, deduce the origin of this problem and design considerations for DES.
- (8 marks)
- Q4** Evaluating the biocompatibility of biomaterials is a critical step in biomedical research and the development of medical devices and implants. Biocompatibility refers to the ability of a material to perform its intended function without eliciting any adverse effects on living tissue or the host organism. Several techniques are employed to evaluate the biocompatibility of biomaterials. Fill up all the fields in sections (I) to (XII) of **Table Q4**.
- (20 marks)
- Q5** **Figure Q5** shows the preoperative radiographic image of Patient A demonstrates lateralization and subluxation of the right hip, osteoarthritis of the hip joint, and excessive offset deformity with a longer neck of the femur.
- (a) Deduce and explain briefly **THREE (3)** signs and symptoms experienced by Patient A after surgery.
- (6 marks)
- (b) Suggest a suitable implant for Patient A.
- (2 marks)

- (c) Design and label the suitable implant that you have suggested in Q5 (b). Explain each of the important characteristics and materials used to design the implant.

(12 marks)

-END OF QUESTIONS -

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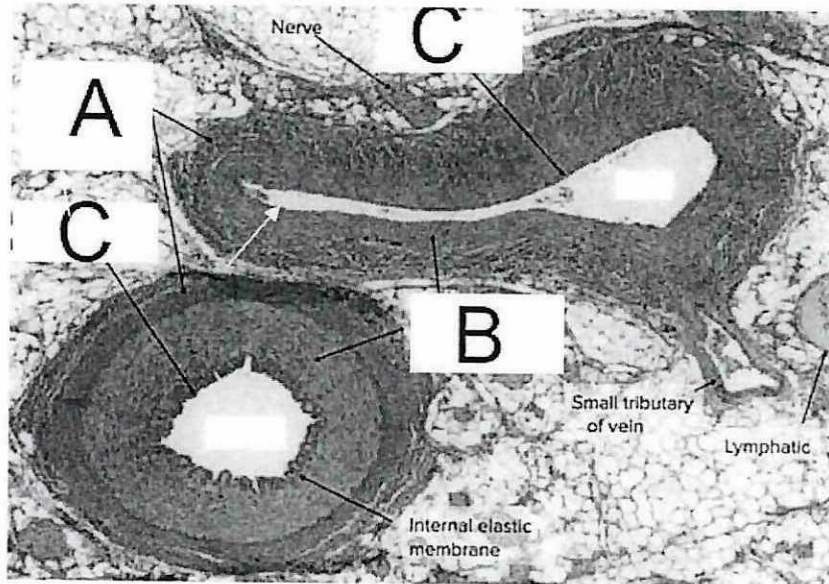


Figure Q1(a)

Table Q4

Biocompatibility assessment techniques	Principle of operation	Types of assay or techniques
(I)	(II)	(III)
(IV)	(V)	(VI)
(VII)	(VIII)	(IX)
(X)	(XII)	(XIII)

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Figure Q5