



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER II  
SESSION 2020/2021**

COURSE NAME : BIOMEDICAL MATERIALS  
COURSE CODE : MEU 10303  
PROGRAMME CODE : MEE  
EXAMINATION DATE : JULY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS  
**OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

- Q1 (a)** Name the **THREE (3)** levels of solid structure and state the importance of understanding these levels. (4 marks)
- (b)** You are planning to develop an artificial bone, suggest and justify the type of material bonding of a material in order to closely mimic the function of the bone and give **ONE (1)** example of the material that can be used. (6 marks)
- (c)** Explain in detail the significance of surface and bulk properties of materials in affecting the biocompatibility of materials. (10 marks)
- Q2** Hip implants have undergone significant changes since their introduction in both materials and design. These changes have led to the development of more successful biomaterial in orthopaedic applications.
- (a)** Propose a methodology that can be used for the future developments of orthopaedic implant in orthopaedic materials engineering and justify why this has been so critical to the success of orthopaedic implants. (10 marks)
- (b)** Current biomaterials technology in hip implants are more successful than their predecessors. Interpret this statement from biological perspective. (10 marks)
- Q3 (a)** **Figure Q3(a)** illustrates the evolution of biomaterials. The rapid growth in the field allows for continuous improvement towards the benefit of mankind. Analyze the trends by pointing out major achievement on each stage. Your elaboration shall include **ONE (1)** suitable example to support your point of view. (12 marks)
- (b)** 3D scaffolds fabrication is important to realize biomaterials for various applications. Distinguish **FOUR (4)** types of fabrication techniques and contrast in terms of its merit and demerit. (8 marks)
- Q4 (a)** You are responsible of a new polymer project intended for surface modification an adhesion. Three companies *X, Y, Z* have proposed their polymers that produced reliable result in strong bonding of fibrous tissue to the surface. In support of their claims they provide the following data of adhesion force, ( $\nu$ ) versus fibronectin, ( $Fn$ ) as shown in **Figure Q4(a)**. Perform product evaluation to select which polymer works the best. Justify your selection. (8 marks)

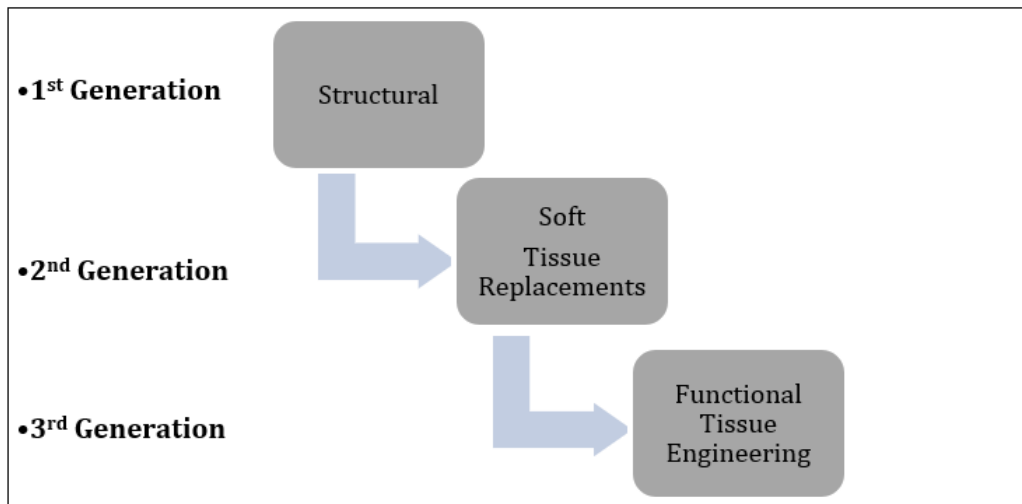
- (b) Define biomaterial characterization process. State the importance of this procedure.  
(4 marks)
- (c) Describe further on bio-composite. Your explanation should include the definition, sub-categorization, and examples of each.  
(8 marks)
- Q5** (a) In line with tissue engineering progress, biomaterials designed for organ transplant need to survive both in-vivo and in-vitro environment. Assess **EIGHT (8)** pillars of biomaterials characteristics required to produce a relevant biomaterial for the industry.  
(16 marks)
- (b) Illustrate skin grafting process to replace burnt/scar tissue.  
(4 marks)

**-END OF QUESTIONS –**

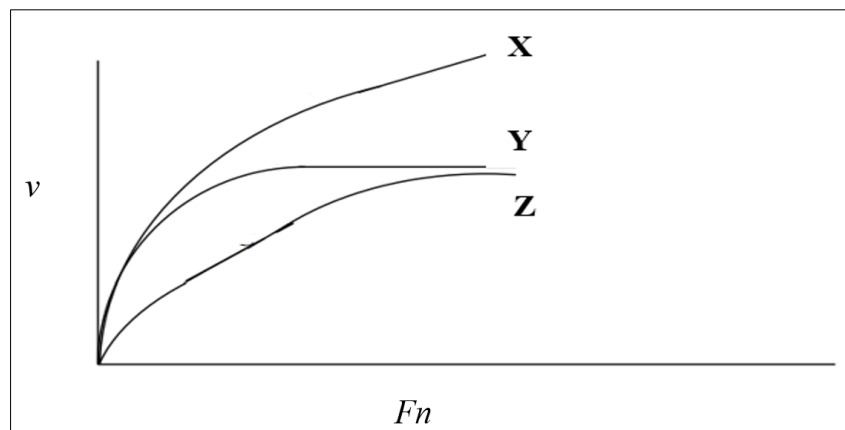
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**Figure Q3(a): Stages of Biomaterials Evolution**



**Figure Q4(a): Graph of adhesion force ( $v$ ) versus fibronectin ( $Fn$ )**