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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016**

COURSE NAME : BIOMEDICAL ENGINEERING AND APPLICATIONS
COURSE CODE : BEU 41503
PROGRAMME : BEJ
EXAMINATION DATE : JUNE / JULY 2016
DURATION : 3 HOURS
INSTRUCTION : ANSWER **ALL** QUESTIONS AND THIS QUESTION PAPER MUST BE **RETURNED**

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

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- Q1**
- (a) Identify **THREE (3)** workplaces and job descriptions where one can practice biomedical engineering. (6 marks)
 - (b) Provide **TWO (2)** benefits of joining a biomedical engineering professional society. (4 marks)
- Q2**
- (a) By giving examples, discuss the evolution of biotechnology from ancient to modern biotechnology. (7.5 marks)
 - (b) Researchers have alternatively studied tissue explant cultures due to challenges associated with understanding fundamental mechanisms of cell behavior at the complex, in vivo level. Describe types of cell used in the cell culture. (6 marks)
 - (c) Analyse how the Atomic-Force Microscopy (AFM) enable to produce a very precise scanning compare to other types of microscopy. (8 marks)
 - (d) Flow cytometry is a biophysical technology used in biotechnology.
 - (i) Identify the difference between a microscope and a flow cytometer. (4 marks)
 - (ii) Summarise the operation principle of the flow cytometer. (6 marks)
 - (e) Explain **TWO (2)** techniques used in molecular biology. (4 marks)
 - (f) By associating with actual situation(s), discuss the constraints in vaccine development. (5.5 marks)
 - (g) Justify why only somatic cells and not germ cells are targeted for treatment in gene therapy. (5 marks)

- Q3** (a) Biomechanics combines engineering and the life sciences by applying principles from classical mechanics to the study of living systems. Give **THREE (3)** scopes of study in biomechanics. (4.5 marks)
- (b) For severe fractures, bone plates are surgically implanted to hold the bone in place. Identify the important considerations when developing the bone plate. (4.5 marks)
- (c) The bone plate in **Figure Q3(c)** has a cross-sectional area A measuring 5 mm by 10 mm and is subjected to the axial load $P = 450$ N. Determine:
- (i) the axial stress; (4 marks)
- (ii) the shear stress acting over the shaded section, which is oriented at $\theta = 50^\circ$ from the horizontal. (6 marks)

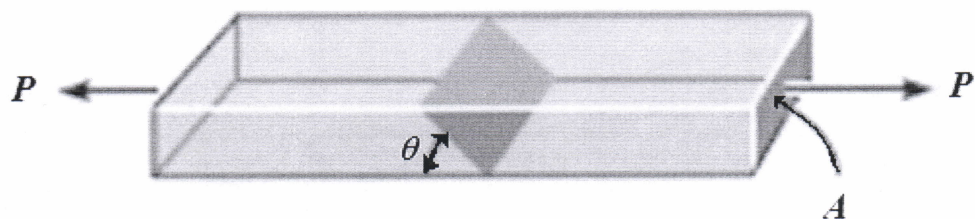


Figure Q3(c)

- (d) Viscoelasticity is the property of materials that exhibit both viscous and elastic characteristics when undergoing deformation.
- (i) Define the words elastic and viscous by associating with a mental model of elastic and viscous materials and its stress-strain relation. (6 marks)
- (ii) State **TWO (2)** constitutive models of viscoelasticity used to characterize materials. (3 marks)
- (iii) Illustrate the models of viscoelasticity in **Q3(d)(ii)** using springs and dashpots. (4 marks)
- (iv) Formulate the constitutive equations according to the models illustrated in **Q3(d)(iii)**. (6 marks)

- (v) Identify each of the variables from the constitutive equations in **Q3(d)(iv)** if the models are equivalently represented as electrical circuits.

(6 marks)

– END OF QUESTIONS–