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Family Name					
Given Name/s					
Student Number					
Teaching Period	Semester 2, 2018				

ENG429 – Biomedical Engineering	DURATION	
	Reading Time:	10 minutes
	Writing Time:	180 minutes
INSTRUCTIONS TO CANDIDATES		
<p>Please do not use pale fine blue pens or pencil, please use a dark blue or black pen.</p> <p>This paper consists of thirty nine (39) questions. You are required to answer any twenty five (25) questions.</p> <p>Each question is worth 4 marks. The total mark for this examination is 100.</p>		
EXAM CONDITIONS		
<p><u>You may begin writing from the commencement of the examination session.</u> The reading time indicated above is provided as a guide only.</p>		
This is a RESTRICTED OPEN BOOK examination		
Any non-programmable calculator is permitted		
No handwritten notes are permitted		
Any hard copy, unannotated English dictionary is permitted		
ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED	
Lecture Notes (Unannotated) Lecture Textbook/s (Unannotated)	1 x 20 Page Book	

**THIS EXAMINATION IS PRINTED
DOUBLE-SIDED.**

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LEFT BLANK.**

**Answer any 25 Questions.
Each question is worth 4 marks.**

- 1 When is it useful to use a notch filter for biomedical applications?
- 2 A person is exposed to a certain potential difference. What factors determine the physiological effects on his body?
- 3 When does a defibrillator need to be used? Explain how a defibrillator works.
- 4 A cricket umpire in a staff versus students match receives chocolate from a few players who intent to bribe her. They know that she likes chocolate but they are unaware that she has several dental fillings. Because she needs to keep her eyes on the match she puts the chocolate in her mouth without looking and does not notice that it is still wrapped in aluminium foil. Will her experience depend on the type of material used for her fillings (amalgam or ceramics)? Explain your answer.
- 5 Compare and contrast MRI and ultrasound.
- 6 Why are dialysis machines based on the counter flow principle?
- 7 A biomedical sensor does not seem to give correct information. List some potential causes for this problem.
- 8 What are the main constituents of blood that are incorporated in models of blood flow?
- 9 What is the relevance of a stress strain curve for a biomaterial that is used to fix broken bones?
- 10 What is a composite material? Give two examples of biological composite materials.
- 11 In your opinion, what is the most important development in biomedical engineering *after* 1955? Explain your answer.
- 12 Besides the strength of a material, what other properties of materials need to be considered if the material is used for biomedical purposes and what tests are available to determine what these properties are?
- 13 Consider a bone to be a perfect cylinder with an outer diameter of 2 cm and a thickness of 2 mm. During a compression test it is shown that the bone can withstand 16 kN before it fractures. What is the maximum stress the bone can withstand?
- 14 A company has asked your advice on a product they are considering. It is a polymer used to fill defects in the face. It is to be injected as a liquid and then it will polymerize in the tissue to form a soft mass. What questions do you want to ask about this polymer before considering this use?

- 15 What is meant by spatial resolution of an image? Why is this relevant for medical purposes?
- 16 Explain briefly the main challenges in modeling blood flow in the body.
- 17 Is it always necessary to use an AD converter for biomedical signals? Explain your answer.
- 18 What questions would you ask to establish whether the risk of exposing a person to a certain dose of X-rays is acceptable?
- 19 What are the categories of hazards associated with biomedical devices?
- 20 What advances in biomedical engineering do you expect in the next two decades? Explain your answer.
- 21 What imaging techniques have been affected by the increase in computing power? Explain your answer.
- 22 An artificial heart valve has been used for a number of years and there is some concern that it might fail. What part of the valve do you expect to fail first? Explain your answer.
- 23 What is SPECT?
- 24 Why did Hodgkin and Huxley use axons of a squid for their experiments instead of axons of a mammal?
- 25 Why is it important to keep the temperature within narrow limits in an infant incubator? Is it useful to place the temperature sensor directly on the body of the infant? Explain your answer.
- 26 A patient has been provided with a new prosthesis. How can you investigate whether this prosthesis is functioning satisfactory?
- 27 How can auditory evoked potentials be used to test hearing in infants?
- 28 How can the strength of muscle contraction be increased?
- 29 Some implantable drug delivery systems can be controlled by the patient. Explain how this is done and give an example of an application of such a drug delivery system.
- 30 You are asked to design a remote monitoring system for a Mount Everest expedition. What variables would you want to monitor? Explain your answer.
- 31 The interfaces are often the main challenge in designing and constructing artificial joints. Explain what the relevant interfaces are for an artificial hip joint and what the main challenges are with each interface.
- 32 A person is not hearing well. Give at least three possible causes and explain what can be done about them.
- 33 People have been trying to make a functional artificial heart for more than 50 years but the results are still not satisfactory. Give some potential reasons for this failure.

- 34 Explain why cochlear implant work better for deaf adults who once had normal hearing than for adults who were born deaf.
- 35 Name two vitamins which affect the strength of bone and indicate whether they affect the strength of bone in compression or in tension.
- 36 What is the advantage of electro-microscopy compared to light microscopy? In what way contributed this to the development of the sliding filament theory?
- 37 Explain how kidney stones can be removed without requiring general anesthetics.
- 38 In a pathological condition known a coarctation of the aorta, the lumen (internal space) of the aorta becomes narrowed due to an external compression of its walls (a squeezing action). How do you expect that the blood pressure in the body will be affected by this condition? Explain your answer.
- 39 Give an example of a sensor that can measure displacement or movement. Give an example of a medical application of this sensor.