

Student ID: _____



UNIVERSITY OF GHANA
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BSC. ENGINEERING
SECOND SEMESTER EXAMINATIONS: 2016/2017
DEPARTMENT OF BIOMEDICAL ENGINEERING
BMEN 306: DESIGN AND SELECTION OF BIOMATERIALS (3 CREDITS)

INSTRUCTIONS:

PLEASE READ THE PREAMBLE BELOW CAREFULLY AND ATTEMPT ALL QUESTIONS, MAKING SURE YOUR ANSWERS ARE DIRECTLY LINKED TO THE SCENARIO DESCRIBED.

PROVIDE ALL ANSWERS ON THE QUESTION SHEETS, IN THE SPACES PROVIDED.

TIME ALLOWED: TWO AND HALF (2½) HOURS

A parent noticed a few months after the birth of her child that the left leg of the child was growing at a much slower rate than the right leg. By the time the child was 6 years old, the right leg was 10 cm longer than the left. An engineer would like to design an orthotic appliance to address problems related to the asymmetry in the leg length of the child.

1. a. What is **design thinking** and how can it be applied in the context of this project?
[5 marks]

- b. With regard to this project distinguish between a prototype and a mock up.
[5 marks]

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2. From the preamble what two problems can the engineer address using the Engineering Design Process? [6 marks]

3. Develop an objective tree based on the problems identified. [10 marks]

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4. To aid in the development of specifications for **materials** to be used in addressing the problem identified, complete the following table by filling in the blanks. Please focus on the performance/functional characteristics of the appliance: [15 marks]

	Requirement	Engineering Characteristics
	Material must be the right shape and size.	Dimensions
		Shape
a		
b		
c		
d		
e		

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5. Develop **detailed** specifications for the orthotic appliance. Show all calculations, where necessary. [15 marks]

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6. Complete the Morphological Chart below for the three most important functions of the orthotic appliance. [10 marks]

Morphological Chart for Orthotic Appliance			
Function	Option 1	Option 2	Option 3

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7. Based on your answers to Questions 4, 5 and 6 above, present clearly labeled diagrams to show three feasible design concepts for the orthotic appliance. Briefly explain why each concept is feasible. [9 marks]

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8. Based on the project objectives and specifications, select the most suitable concept from the three developed. [10 marks]

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9. Briefly describe the systematic process of material selection for the various components of your chosen concept. [10 marks]

10. List 5 specific actions the engineer can take during the engineering design process in order to ensure that the design of the orthotic appliance can be covered by intellectual property rights. [5 marks]

a.
b.
c.
d.
e.