Researchers in Schools

Replacing Body Parts

Pupil Name

Coursebook Designed by **S. Tetteh, PhD**

Timetable and Assignment Submission

Timetable – Tutorials

Tutorial	Date	Time	Location
1			
2			
3			
4			
5			
6 (Feedback)			
7 (Feedback)			

Timetable – Homework Assignments

Homework Assignment	Description	Due Date
Tutorial 1	Let's replace some body parts – Introduction to Prosthetics	
Tutorial 2	Let's not forget – Ergonomics & Human Factors	
Tutorial 3	Let's dig deeper – Design Specification	
Tutorial 4	Putting it all together – The Engineering Design Process	
Tutorial 5	Let's Pick Up Some Materials – Material Selection	

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after midnight on 9th August	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Contents

Course Rationale **4**

Mark Scheme **5**

Glossary of Keywords **9**

Tutorial 1 Introduction to Prosthetics **10**

Activity 1: Function of Medical Products **10**

Activity 2: Identifying Medical Products **11**

Tutorial 2 Ergonomics & Human Factors **13**

Activity 1: Inclusive Design **13**

Activity 2: Anthropometric Measurements **14**

Tutorial 3 Design Specification **19**

Activity 1: Specification Worksheet **19**

Tutorial 4 Engineering Design Process **22**

Activity 1: Lab stool redesign **23**

Activity 2: Fabrication Process Video **24**

Tutorial 5 Material Selection **26**

Activity 1: Ankle Joint Material Selection **26**

Tutorial 6 **30**

Reflection on feedback **31**

Tutorial 7 **32**

Reflecting on the course **33**

Appendices **34**

Referencing correctly **34**

Course Rationale

Lots of people lose body parts due to accidents, cancers and birth defects all over the world. Mostly due to accidents, illnesses, cancer and many others. Some of the body parts are internal or external of the human body. The human body is an engineering masterpiece, when its fully functional. Replacement of body parts involves lots of disciplines in engineering: biomedical, chemical, materials, electrical, mechanical; medical doctors and surgeons; product designers, research scientists, prosthetists and many others. In replacing body parts many academic disciples are also involved such as biology, chemical, mathematics, design and technology and physics.

Our changing world needs prosthetics due to accidents, a rise in cancer which means more people are needed in this field in the materials and technologies, utilizing modern technologies in medicine in improving the quality of life of these people.

The workbook introduces you to an awareness of prosthetics and orthotics through topics in ergonomics, anthropometry, material science selection, product development and specification. Furthermore, it provides hands on activities, encourages creativity and provides an interconnecting link to lessons in science lesion (maths, physics, biology and chemistry).

Uni Pathways Mark Scheme 2019 – Essay-based assignments

	Skills	1st (70-100)	2:1 (60-69)	2:2 (50-59)	3rd (40-49)	Mark /100
Subject knowledge	Knowledge and understanding	o All content included and materials used are relevant to the general topic and to the specific question/title o Good understanding of all the relevant topics. o Technical terms are defined and used accurately throughout o Clear justification of how the material and content included is related to the specific issues that are the focus of the assignment	o Most of the materials used and content included are relevant to the general topic and to the specific question/title o Good understanding of most the relevant topics o Technical terms are mostly defined and used accurately o Adequate justification of how the material used and content included are related to the specific issues that are the focus of the essay	o Some of the materials used and content included are relevant to the general topic and to the specific question/title o Good understanding on some of the relevant topics but occasional confusion on others o Technical terms are sometimes used and defined accurately o Some justification of how the material used and content included are related to the specific issues that are the focus of the essay	o The content included and materials used are not applied to the question/title in a relevant manner o There is confusion in how understanding of the topics is expressed	
Critical thinking	Research and evidence	o Includes rich sources of research findings, data, quotations or other sourced material as evidence for the claims/ideas o Uses evidence/calculations to support claims/assertions/ideas, consistently clearly and convincingly o Evidence of further reading beyond materials provided which were used in an appropriate context o Data is effectively analysed and appropriate assumptions/conclusions are reached	o Includes adequate sources of research findings, data, quotations or other sourced material as evidence for the claims/ideas o Uses evidence/calculations to support claims/assertions/ideas, mostly clearly and convincingly o Evidence of further reading beyond materials provided o Data is analysed and the assumptions/conclusions that are reached are mostly appropriate	o Includes some sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas o Uses evidence/calculations to support claims/assertions/ideas, at times clearly and convincingly o Limited evidence of further reading beyond materials provided o There is an attempt to analyse data is and draw assumptions/conclusions	o Inclusion sources and materials is very limited and mostly not attributed o Applicable sources are rarely used to support ideas. o Data is not used or few appropriate conclusions are drawn from it.	
	Developing an argument	o A point of view or position in relation to the title or question is consistently clear. The position is developed effectively and consistently throughout the essay o Argument is exceptionally well-developed and well-justified o Makes links effectively between subjects that have not previously been associated o Uses concepts from the tutorials in an unfamiliar context and does so accurately and confidently. o Content is analysed effectively to support the argument	o A point of view or position in relation to the title or question is adequately clear. The position is well-developed in most of the essay o Argument is clear and well-developed, and position is justified o Some evidence of linking subjects that have not previously been associated o Uses some concepts from the tutorials in an unfamiliar context, but not always accurately o Analyses content to support the argument	o A point of view or position in relation to the title or question is somewhat clear. The position is well-developed in parts of the essay o Argument is clear but not well-developed o Limited evidence of linking subjects that have not previously been associated o Limited use of concepts from the tutorials in other contexts o Uses some analysis of content to support the argument	o There is not a clear point of view or position taken and sometimes the argument is not clearly established	

	Critical evaluation	○ Moves beyond description to an assessment of the value or significance of what is described ○ Evaluative points are consistently explicit/systematic/reasoned/justified ○ Effectively critiques the reliability of sources provided	○ Mostly description but some assessment of the value or significance of what is described ○ Evaluative points are mostly explicit/systematic/reasoned/justified ○ Some evidence of critiques on the reliability of sources provided	○ Describes with minimal assessment of the value or significance of what is described ○ Evaluative points are at times explicit/systematic/reasoned/justified ○ Limited evidence of critiques on the reliability of sources provided	○ The work is descriptive in nature and there is a lack of critical engagement in the value of sources	
Written communication	Structure and presentation	○ Ideas are presented in paragraphs and arranged in a logical structure that is appropriate for the assignment ○ The introduction clearly outlines how the essay/report will deal with the issues ○ The conclusion summarises all the main points clearly and concisely ○ All calculations, formulas and methods are clearly structured, clear to follow and correct ○ Tables and graphs are effectively constructed including appropriate headings, units and scales. ○ All sources are referenced correctly in an agreed format	○ Ideas are presented in paragraphs and arranged in a structure that is mostly appropriate for the assignment ○ The introduction adequately describes how the essay/report will deal with the issues ○ The conclusion summarises most of the main points clearly ○ Calculations, formulas and methods are mostly structured, clear to follow and correct ○ Most tables and graphs are well constructed ○ Most sources are referenced correctly in an agreed format	○ Ideas are presented in paragraphs and arranged in a structure ○ The introduction mentions how the essay/report will deal with the issues ○ The conclusion summarises some of the main points clearly ○ Calculations, formulas and methods are not always structured, clear to follow and correct. ○ Some tables and graphs are well constructed but contains some errors ○ Some sources are referenced correctly in the agreed format with occasional errors	○ Ideas are presented in paragraphs but there is a lack of structure in how the work is presented ○ The work lacks an introduction that establishes the scope of the question ○ The work lacks a conclusion that summarise the main points raised ○ Work is not referenced accurately	
	Language and style	○ No spelling, grammar or punctuation errors ○ Writing style consistently clear, tone appropriate and easy to follow ○ Accurate and consistent use of technical language and vocabulary	○ Minimal spelling, grammar or punctuation errors ○ Writing style mostly clear, tone appropriate and easy to follow ○ Some attempts of using technical language and vocab alary, but not always accurate	○ Some spelling, grammar or punctuation errors ○ Writing style moderately clear, tone appropriate and easy to follow ○ Use of simple language and vocabulary effectively but struggles to use technical language	○ There are a significant number of spelling, grammar and punctuation errors ○ Use of simple language and vocabulary effectively but a lack of technical language	
Overall Mark (average of the 6 marks from the criteria above)						

Baseline Assignment (essay based): Pupil Feedback Report

Name of Pupil	
Name of School	Weston Favell Academy
Name of RIS teacher	S. Tetteh, PhD
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Knowledge and Understanding		Research and Evidence	
	mark		*mark*
Developing an Argument		**Critical Evaluation**	
	mark		*mark*
Structure and Presentation		**Language and Style**	
	mark		*mark*

Final Assignment (essay based): Pupil Feedback Report

Name of Pupil	
Name of School	Weston Favell Academy
Name of RIS teacher	S. Tetteh, PhD
Title of Assignment	

How your assignment is graded:

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Marks

OVERALL MARK / 100		FINAL MARK / 100 (including any deductions)	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Mark Breakdown and Feedback

Knowledge and Understanding		Research and Evidence	
	mark		*mark*
Developing an Argument		**Critical Evaluation**	
	mark		*mark*
Structure and Presentation		**Language and Style**	
	mark		*mark*

Subject Vocabulary

Word	Definition	In a sentence
Prosthetics	Is an artificial body part to cover a part of a person's body to change their appearance	The doctor gave Tim a replacement prosthetic for his amputated lower limb
Anthropometry	The study of measurements and proportions of the human body	In designing a space suit for the astronauts we had to take into account the anthropometry of their bodies
Effectiveness	How successful something is in getting a desired result	The drugs effectiveness is certain.
Implant	Is artificial object that is either fixed or inserted into a person's body usually by surgery	
Orthotic	Is an artificial device that is used to enhance a person's weakened of deformed regions of the body	The handy man always wore a back brace orthotic when working
Objective	Not influenced by personal feeling or opinions	I cannot be objective when judging my family's work
Non objective	Influenced by personal feeling or opinions	John claims of the dog next door being quite is non objective
Prosthetist	A person who makes or fabricates prosthetics	
Alignment	Relative position or orientation of the prosthetics to the human body	At John yearly appointment, the prosthetist checked the alignment of his prosthetic to his anatomy
Cosmesis	The natural appearance of prosthetics achieved by a lifelike covering fitted over its components	The lady who got acid poured on her, has recovered and received a better cosmesis to cover her facial scars
Design brief	This is a written document for a design project that would usually have information on the purpose, specification set by a client, constraints and many others	We have been given a design brief by the company to come up with new ideas for the project

Tutorial 1 – Introduction to Prosthetics

What is the Purpose of Tutorial 1?

- Explain and have a broad understanding of the field of prosthetics
- An awareness of the different types of prosthetics, orthotics or implants
- Why the need for these medical products?

Activity 1: Function of Medical Products

Tick **(x)** in the columns (on the right) which of the functions matches to prosthetics, orthotics and implant.

Functions	Prosthetics (P)	Orthotics (O)	Implant (I)
Prevents deformity from progressing			
Aid bodily movement			
Relieve pain			
Replaces missing body part internally			
Replaces missing body part externally			
Restores normal function of missing body part			
Provides an aesthetic look			

Notes:

Activity 2: Identifying Medical Products

Baseline Assignment Title: Fabricating a Prosthetic

You are an engineering student at the University of Cambridge. A start up company has assigned a project to you to fabricate a prosthetic. How would you go about in ensuring that prosthetics are made?

Baseline assignment instructions:
The essay assignment should be around 200 – 300 words. The questions below should serve as a prompt/guide for your essay assignment. Access the library if you need resources when completing this assessment.

Include an introduction stating your overall perception of prosthetics
What are prosthetics?
How are prosthetics made?
What would you consider in fabricating a prosthetics?
Summarise – your keys findings in a conclusion

Baseline Assignment Success Criteria	
Knowledge and understanding	Include content that is relates to the broad field of prosthetics. Understanding the causes and the need of prosthetics Understand and explain key words from the glossary and demonstrate a full understanding to the topic at hand.
Research and evidence	Include research findings from a wide range of sources.

Developing an Argument	As well as using the sources provided, you should be discovering some sources yourself from the independent work that you do outside tutorials. Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials.
Critical Evaluation	Include evaluation of what is being described and provide clear justification and reasoning. Select relevant research evidence to back up your thinking.
Structure and Presentation	Organise your ideas in paragraphs with a logical structure Include an introduction that clearly outlines what the assignment will contain. Include a conclusion that summarises all the key points clearly. Make sure that you have referenced everything correctly
Language and Style	Make sure your spelling, grammar and punctuation are accurate. Use a formal style of writing that is appropriate for an academic essay.

Tutorial 2 – Ergonomics & Human Factors

What is the Purpose of Tutorial 2?

- Understand how ergonomics and human factors influence design
- An awareness of what inclusive design is
- Able to use anthropometric data

Starter: Pop Quiz

Activity 1: Inclusive Design

- Please answer the questions below:

Think of a product that is adjustable and explain why/how its adjustable parts are useful.

_____

_____

_____

_____

What are the 5 psychological factors in designing?

a) _____

b)_____

c)_____

d)_____

e)_____

Name a place/location where sociological factors are important.

_____

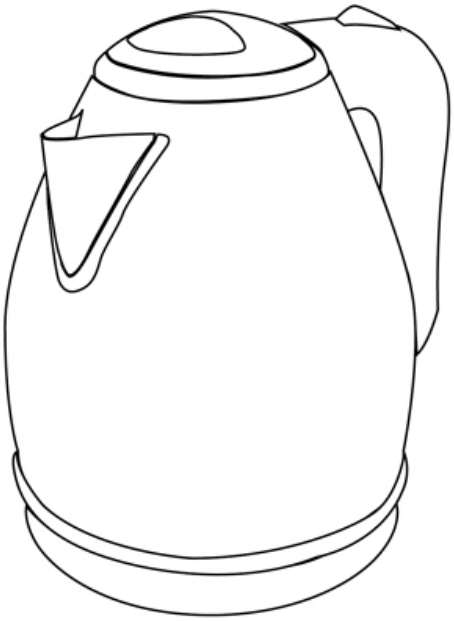
_____

_____

_____

_____

Circle parts of the kettle where anthropometric data has been used.



Activity 2: Anthropometric Measurements

Now let us take anthropometric measurements of our palms. This will be recorded in your booklet. We will then work out the averages in each of the column and write them in the rows provided. To work out the average, add up the total from each column and divide by the amount of people.

a. Width of hand
b. Length of finger
c. Span (from the top of the thumb to the last finger)

Name	Width of hand (mm)	Length of finger (mm)	Span – from thumb to finger (mm)
1.			
2.			
3.			
4.			
5.			
6.			
Average			

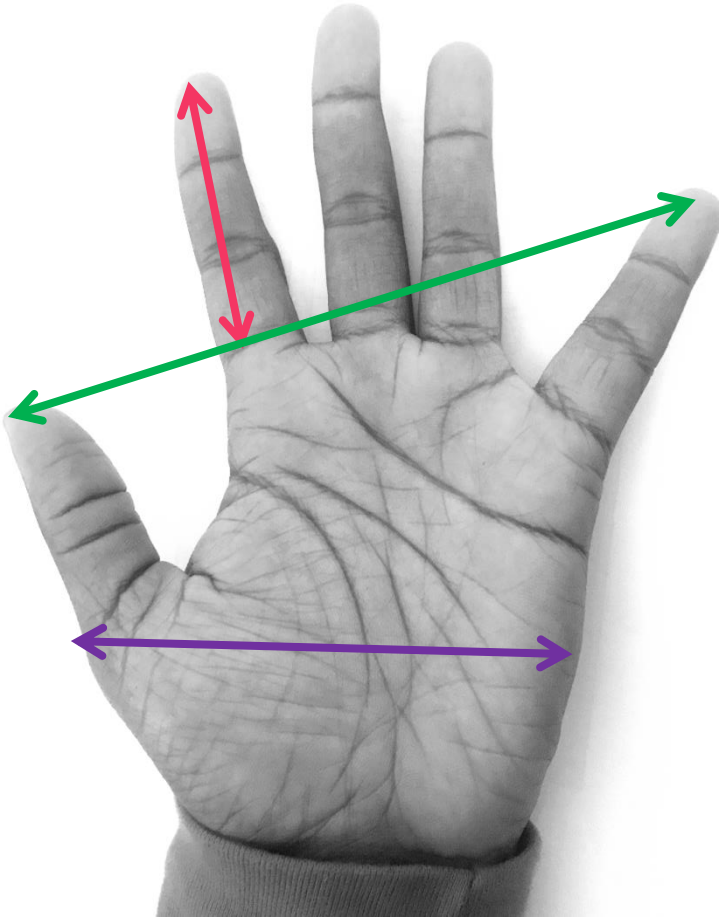
Additional Notes:

_____

_____

_____

_____



Why is anthropometry necessary for prosthetic design?

_____

_____

_____

b. Where can we find anthropometric data if we cannot collect the data directly from patients?

_____

_____

_____

Homework Title: Factors to Consider in Ergonomics & Anthropometrics

Homework Instructions:

Please answer the questions below.

Think of a product that is inclusive and state why you think it is. (You can draw in the space below)

_____

_____

_____

_____

Think of a product that is exclusive and state why you think it is.

_____

_____

_____

_____

_____

When using anthropometric data what is the 5th percentile or 95th percentile? Give an example of someone who would be in this range and why.

5th Percentile

_____

_____

_____

95th Percentile

_____

_____

_____

What percentile do we normally use? Why?

_____

_____

_____

_____

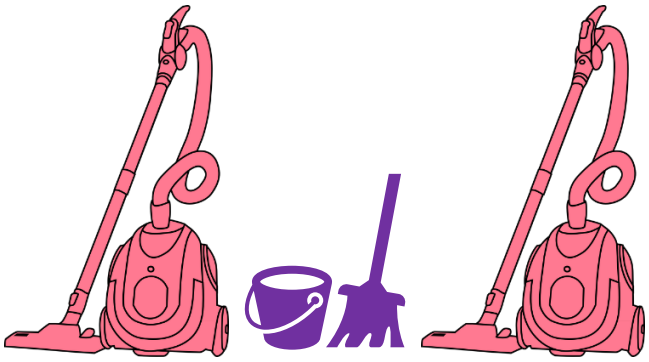
Notes:

Homework Success Criteria	
Knowledge and understanding	Include content that relates to the factors for ergonomics.
Research and evidence	Include research findings of what is important in designing (consider anthropometrics and ergonomics) As well as using the sources provided, you should be discovering some sources yourself from the independent work that you do outside tutorials.
Developing an argument	Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials.
Critical evaluation	Include evaluation of what is being described and provide clear justification and reasoning. Select relevant research evidence to back up your thinking.
Structure and presentation	Organise your ideas in paragraphs with a logical structure Make sure that you have referenced everything correctly
Language and style	Make sure your spelling, grammar and punctuation are accurate. Use a formal style of writing that is appropriate for an academic essay.

Tutorial 3 – Design Specification

What is the Purpose of Tutorial 3?

- Develop qualitative and quantitative criteria as well as constraints from a brief
- Understand the needs and wants of a customer or client
- Translate design specifications in the design process
- Analyse a product in order to develop design criteria



Starter: Dyson Domino Started Pack Activity		
Activity 1: Specification Worksheet – Dyson Kit		
	Explanation	Your Response
A	What will the product look, feel or sound like?	
C	What is the estimated manufacturing cost of the product and what is its retail price going to be?	
C	Who is the product designed for?	
E	Environment. What is the product's impact on the environment?	
S	Safety. How will the user be kept safe from harm?	
S	Size. Are the proportions of the product appropriate?	
F	Function. How well does the product work and is it easy to use?	
M	Materials. What is the product made from, and what does this mean for manufacturing?	

Homework Title: Ouch I Broke my Hand

You are on a hiking trip at the Mam Tor, Peak District with you class on a Geography trip. The weather is sunny and lovely; within a few hours it starts raining and the class runs for cover at the nearest shelter. Whilst running you slip and sprain your hand. As recommended by the doctor, you have been diagnosed to wear a hand brace to enable your hand to heal faster.

Specification Worksheet for Hand Brace

	Explanation	Response
A	What will the product look, feel or sound like?	
C	What is the estimated manufacturing cost of the product and what is its retail price going to be?	
C	Who is the product designed for?	
E	Environment. What is the product's impact on the environment?	
S	Safety. How will the user be kept safe from harm?	

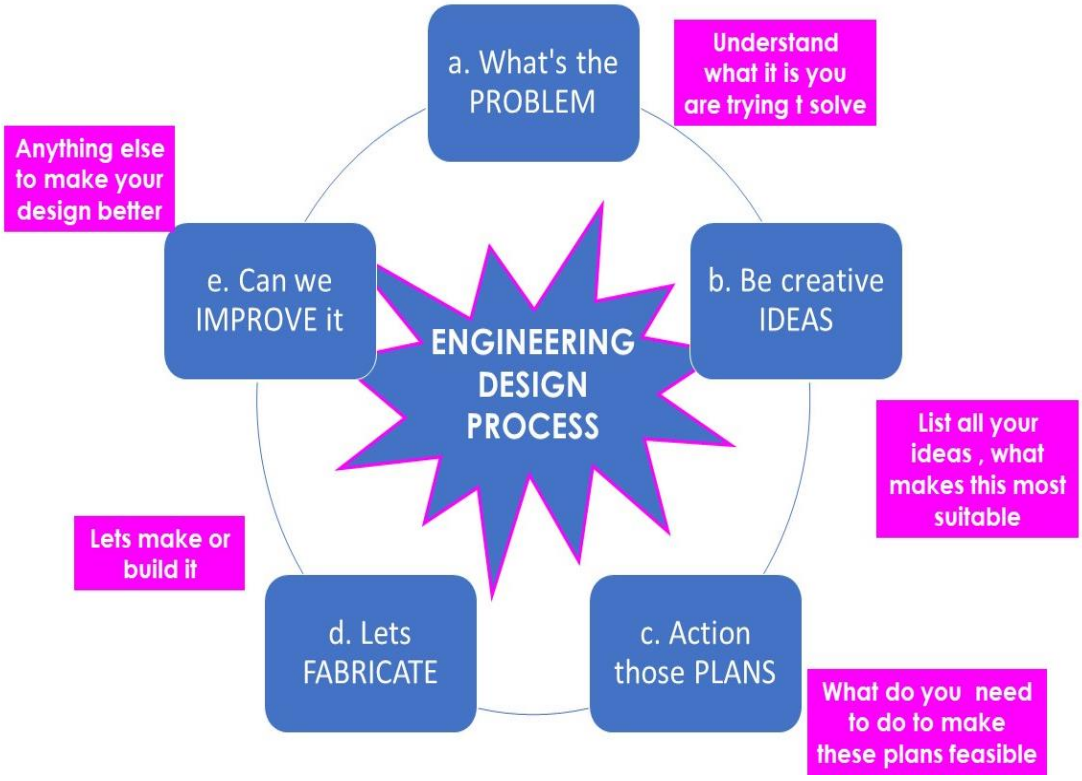
S	Size. Are the proportions of the product appropriate?	
F	Function. How well does the product work and is it easy to use?	
M	Materials. What is the product made from, and what does this mean for manufacturing?	

Homework Success Criteria	
Knowledge and Understanding	Include content that is relates to the design specification that is measurable (quantitative and qualitative) Understanding the importance of the design specification Elicit requirements for the hand brace (based on hand anatomy).
Research and Evidence	Include research findings of what is important in designing a hand brace. As well as using the sources provided, you should be discovering some sources yourself from the independent work that you do outside tutorials.
Developing an Argument	Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials.
Critical Evaluation	Include evaluation of what is being described and provide clear justification and reasoning. Select relevant research evidence to back up your thinking.
Structure and Presentation	Organise your ideas in paragraphs with a logical structure Include an introduction that clearly outlines what the assignment will contain. Include a conclusion that summarises all the key points clearly. Make sure that you have referenced everything correctly

Tutorial 4 – Engineering Design Process

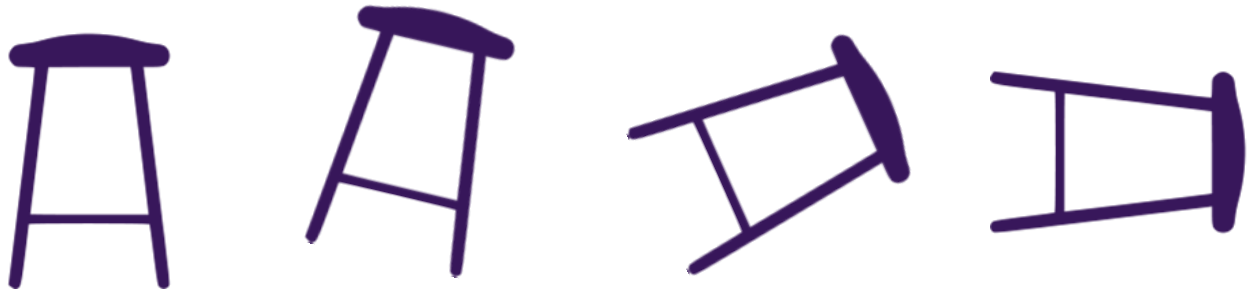
What is the Purpose of Tutorial 4?

- Understand the engineering design process
- Identify the possible key manufacturing processes
- Awareness of issues in manufacturing and processing



Starter: Recap from Previous Tutorial

Activity 1: Lab Stool Redesign



Lab stool found in Science labs tend to be uncomfortable, how will you redesign the ones found in the Science Lab.

Ideas

_____

_____

_____

_____

_____

_____

Plans

_____

_____

_____

_____

_____

_____

_____

Fabricate

_____

_____

_____

_____

Improve

_____

_____

Activity 2: Watch Fabrication Process

Homework Title: Sprained Hand

Problem:

Let's go back to last week's activity, how will you design the hand brace with the new added information we have learnt today.

Ideas

Plans

Fabricate

_____

_____

Improve

_____

_____

_____

_____

_____

_____

Homework Success Criteria	
Knowledge and Understanding	Understanding the engineering process required for starting a project
Research and Evidence	Include research findings from a wide range of sources. As well as using the sources provided, you should be discovering some sources yourself from the independent work that you do outside tutorials.
Developing an Argument	Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials.
Critical Evaluation	Include evaluation of what is being described and provide clear justification and reasoning. Select relevant research evidence to back up your thinking.
Structure and Presentation	Organise your ideas in paragraphs with a logical structure Include an introduction that clearly outlines what the assignment will contain. Include a conclusion that summarises all the key points clearly. Make sure that you have referenced everything correctly
Language and Style	Make sure your spelling, grammar and punctuation are accurate. Use a formal style of writing that is appropriate for an academic essay.

Tutorial 5 – Material Selection

What is the Purpose of Tutorial 5?

- Link between material properties and its usage
- Use and manipulate material related data

Starter: Watch a video

Activity 1: Ankle Joint Material Selection
A company you work, has recently developed a new intelligent ankle joint which can interface with a user's nervous system and is also superior to a natural ankle joint. The manufacturers have designed this advanced foot.

On paper it looks great, but they have to find material properties that will make it suitable for use in this foot. Your task is to find the best material with properties that will make it suitable for use in this foot.

What to look out for:
The main difficulty is finding a material with the correct stiffness. Your lab has done some tests on 4 promising materials and your job now is to complete the data analysis and choose the correct material. Calculations done by the engineers who designed the foot tell us that the material is to be made from the following properties

A <u>stiffness</u> as close to 7.5×10^{11} N/m^2 as possible
A <u>tensile strength</u> as close to 2×10^{9} N/m^2 as possible
A <u>density</u> of no more than 1900 kg/m^3

Have a look at the materials data sheet provided (which provides a table giving certain properties of 4 materials which have been chosen because they may have what it takes to make up the foot component)

For each material there will be 3 values for stress given in N/m^2 and three values for strain (strain has no unites as it is a ratio). For each material you will need to plot a graph of stress against strain and calculate the gradient of the resulting straight line.
The calculated gradient gives you the stiffness.

Once you have calculated the stiffness of each material, view other properties given for each material and decide which one best fits the engineers' requirements.

Reminder: Your goal is to find the most suitable material for a prosthetic foot.

Material	Tensile Strength ($\times 10^8$ N/m^2)	Density (kg/m^3)	Stress (N/m^2 $\times 10^6$)	Strain (ratio no units $\times 10^5$)	Stiffness (otherwise known as Modulus of Elasticity)
A	19.0	1500	1.0	0.05	
			11.0	0.60	
			17.5	0.95	
B	3.2	1552	0.5	0.50	
			1.0	1.10	
			2.0	2.15	
C	25.2	1750	4.0	0.55	
			8.5	1.15	
			15.5	2.10	
D	26.1	2507	11.0	0.70	9.2
			15.0	1.20	
			6.5	1.95	

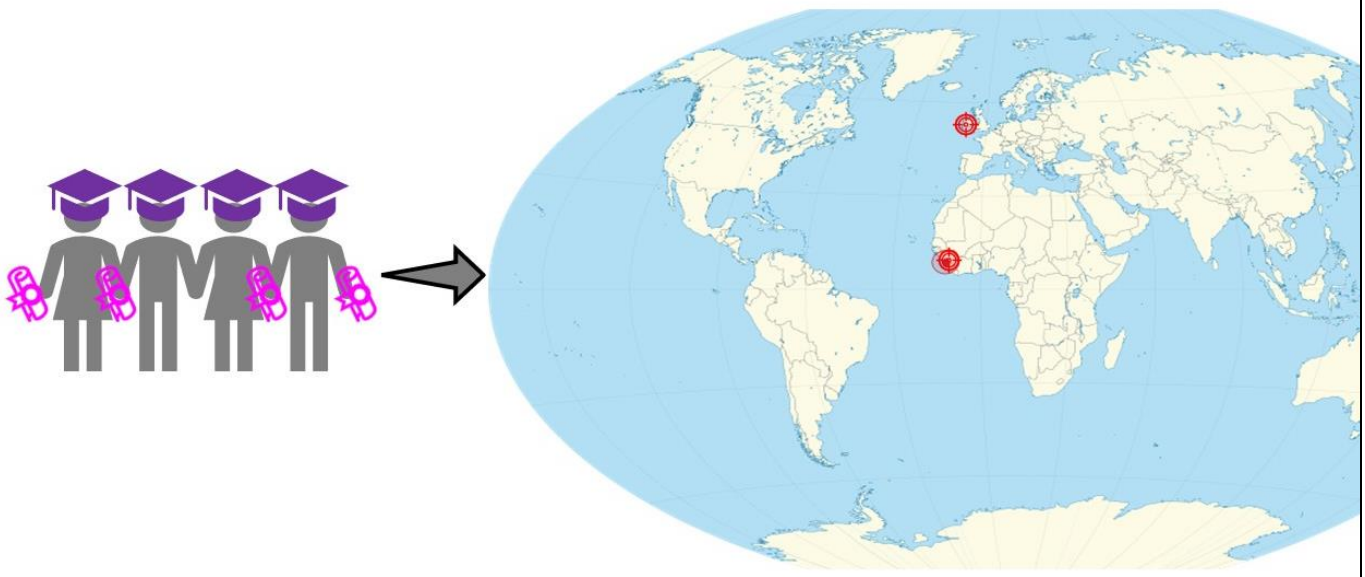
Let's do the calculation for material D

$$\textbf{Stress} = \frac{\textbf{force}}{\textbf{area}} \qquad \textbf{Strain} = \frac{\textbf{change in length or extension}}{\textbf{original length}} \qquad \textbf{Elastic Modulus} = \frac{\textbf{stress}}{\textbf{strain}}$$

Circle which material/s do you think fits the engineers' requirements?

A B C D

Final Assignment: Prosthetic Design Around the World



You have now graduated from University of Cambridge and are now a practising prosthetist/engineer. You just got hired by an agency to work in Sierra Leone (which has had a series of civil wars and a large section of the population require and need prosthetics. How would you go about in ensuring that prosthetics you design, fabricate and manufacture in this region are effective to its users?

Final Assignment Instructions:

The essay assignment should be around **2000 words**. The questions below should serve as a prompt/guide for your essay assignment.
What are prosthetics?

- Write about the
  - types of prosthetics,
  - differing materials, and
  - processing and fabrication methods.
- Will the geographical, context and the environment have an impact on prosthetics fabrication
- Are guidelines/regulations essential for prosthetics assimilation, usage and application
- What are the differing ways in measuring effectiveness of a prosthetics?
  - Objectiveness
  - Non-Objectiveness
- How would you do things differently in assessing the effectiveness of the prosthetics?

Final Assignment Success Criteria	
Knowledge and Understanding	Include content that is relates to the different types of prosthetics, materials used in fabricating prosthetics, as well as processing methods.

	An understanding of how the context affects the possible fabrication process pipeline as well as how guidelines/regulations affects the usage and application Develop skills in scientific methods of enquiry to further scientific knowledge and understanding An understanding of chemical and material behaviour: structures, properties; uses of materials; forces and energy, forces and energy transfer Identify product needs suitable for local context in Sierra Leone Developing pupils knowledge, understanding and skills in the application of mathematical skills to real life and work situations Ability to decide on the appropriate method and equipment to solve problems – (mental written, calculator, mathematical instruments or a combination)
Research and Evidence	Include research findings from a wide range of sources. As well as using the sources provided, you should be discovering some sources yourself from the independent work that you do outside tutorials.
Developing an Argument	Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials.
Critical Evaluation	Give reasons and evidence to back up the points that you make. You might find the PEE structure helpful: • Point – make the key point clear • Evidence – explain the evidence for the point • Explanation – explain why your point is relevant and important Make links to topics you have covered during tutorials as well as some topics that you have not discussed during tutorials. Include evaluation of what is being described and provide clear justification and reasoning. Select relevant research evidence to back up your thinking.
Structure and Presentation	Organise your ideas in paragraphs with a logical structure Include an introduction that clearly outlines what the assignment will contain. Include a conclusion that summarises all the key points clearly. Make sure that you have referenced everything correctly
Language and style	Make sure your spelling, grammar and punctuation are accurate. Use a formal style of writing that is appropriate for an academic essay.

Tutorial 6 – Feedback Tutorial

What is the Purpose of Tutorial 6?

- To receive feedback on your final assignment
- To respond to the feedback from your Uni Pathways teacher
- To write targets for improvement on your final assignment

Final assignment feedback from your Uni Pathways Teacher

(Remember to look at the mark scheme to help you understand what you have done well so far, and how you can do even better in your final assignment)

Here are three things that my Uni Pathways Teacher thought I did well in my draft assignment
•   •   •

Here are three things that my Uni Pathways Teacher thinks that I could do to get a higher mark in my final assignment
•   •   •

Tasks from my Uni Pathways Teacher to do during the feedback tutorial to help me improve
•   •   •
My response:

Actions I will take to improve my final assignment after this tutorial…
•   •   •

Hand in date for my final assignment:	

Tutorial 7 – Final tutorial

What is the Purpose of Tutorial 7?

- To receive feedback and a grade on your final assignment.
- To reflect on the programme including what you enjoyed and what was challenging.
- To ask any questions you may have about university.

Final assignment feedback from my Uni Pathways Teacher

Final mark:	University style grade:
Feedback: Here are three things that my Uni Pathways teacher thought I did well in my final assignment • • •	

Here are three things that my Uni Pathways teacher thinks I should remember for when I am doing this kind of study in the future
• • •

University

What questions do you still have about University after taking part in Uni Pathways?
•   •   •

Reflecting on Uni Pathways

What did you most enjoy about Uni Pathways?
•   •   •

What did you find challenging about the programme?	How did you overcome these challenges?
• • •	• • •

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should I use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

1. **A marker in your assignment**: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].
2. **Bibliography**: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

    a. **Websites** – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

    E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

    b. **Books** – Author, date published, title of book (in italics), pages where the information came from.

    E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

    c. **Articles** – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

    E.g. Maev Kennedy, 'The lights to go out across the UK to mark First World War's centenary', Guardian, 10 July 2014.

References for Workbook:

STEM Learning Educational resources
S. Tetteh PhD Thesis (facial prostheses images)

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Notes

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