UNIVERSITY OF WOLLONGONG IN DUBAI

Assignment Cover Sheet

Subject Code: ENGG102
Subject Name: Fundamentals of Engineering mechanics
Submission Type: Online
Assignment Title: Project 1A

Student Name: Mohamed Emam/Daniel Wazz/Eva Barbulescu

Student Number: 5889571/6301770/6257409

Student Phone/Mobile No. 0502272628/0501481148/0544433884

Student E-mail: me057@uowmail.edu.au/dw916@uowmail.edu.au/edb594@uowd.edu.au

Lecturer Name: Khalid el Akruti
Due Date: 12/10/2018
Date Submitted: 12/10/2018

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Optional Marks:

Comments:

Lecturer Assignment Receipt (To be filled in by student and retained by Lecturer upon return of assignment)

Subject:	**Assignment Title:**
Student Name:	**Student Number:**
Due Date:	**Date Submitted:**
Signature of Student:	

Student Assignment Receipt (To be filled in and retained by Student upon submission of assignment)

Subject:	**Assignment Title:**
Student Name:	**Student Number:**
Due Date:	**Date Submitted:**
Signature of Lecturer	

UNIVERSITY OF WOLLONGONG IN DUBAI

ENGG102 Report

Project number: 1A

Balsa Beam Design and Reflection

Group Name: Q

Group Number: 1

27/09/2018

Name: Mohamed Emam

Student No: 5889571

Name: Eva Barbulescu

Student No: 6301770

Name: Daniel Wazz

Student No: 6257409

Tutors Name: Dr. Khaled El-Akruti

UNIVERSITY OF WOLLONGONG IN DUBAI

Faculty of Engineering and Information Sciences

ENGG102 Project 1A Beam Design and Reflection Report: Assessment sheet

Tutorial number: 1 Tutors name: Dr. Khaled El-Akruti

Team Number: 1 Date and time of exercise: 20/09/2018

Names and ID Numbers: Mohamed Emam 5889571
Eva Barbulescu 6301770 Daniel Wazz 6257409

Aspect	Comment	Mark
Appendix A: Minutes of Team Meetings (evidence of teamwork)	**Minus 2 marks if Minutes of Team Meetings (more than one!) are not included with this Report**	
Appendix B: A completed copy of your Team Ground Rules Contract Form	**Minus 2 marks if a copy of your Team Ground Rules Contract Form is not included with this Report**	
Structure of report, team information etc (as per "what report should contain")	0.5 mark for each item 3-12 (see Report structure provided above)	/5
Overall Presentation	Neatness Spelling Grammar Diagrams Professionalism	/10
Brainstorming and rationale: List 3 distinct proposals Reasons for selection of prototype	Must show evidence of developing at least two distinct design ideas and variations/improvements to one.	/5
Description of beam Drawing/sketches with dimensions	Describe the principle behind the design. Accurate line drawings or neat and clear sketches with all important dimensions (should enable tutor to build the same structure)	/20
Results including comparison with other team(s) WHAT happened!	Comparison table of all results. Discussion of results with commentary on table and main factual findings. Describe the main failure mechanisms.	/10
Reflections – identify some reasons for the performance of your beam and other teams. WHY it happened! Consider the various aspects of the task (fabrication, material use). Discuss how it might be improved, what knowledge might be needed, & design criteria considered.	To achieve top marks (35-40/40) in this section your report must demonstrate clear and insightful reflection considering own solution and others in the class. Demonstrates further reading and critical analysis. To achieve 25-35/40 your report must describe the performances of your solution and some others. Itemisation of knowledge gaps and some critique of designs. To achieve 0-25/40: Describes own solution with limited reference to other beams.	/40
Mapping of learning outcomes	Identifies all the relevant outcomes from subject outline and discusses how well each is addressed.	/5
Conclusion	1 or 2 paragraphs that draw appropriate conclusions from evidence presented in report. Include the main results, both numerical and qualitative.	/5
Total		/100

CONTENTS:

STATEMENT OF PURPOSE:

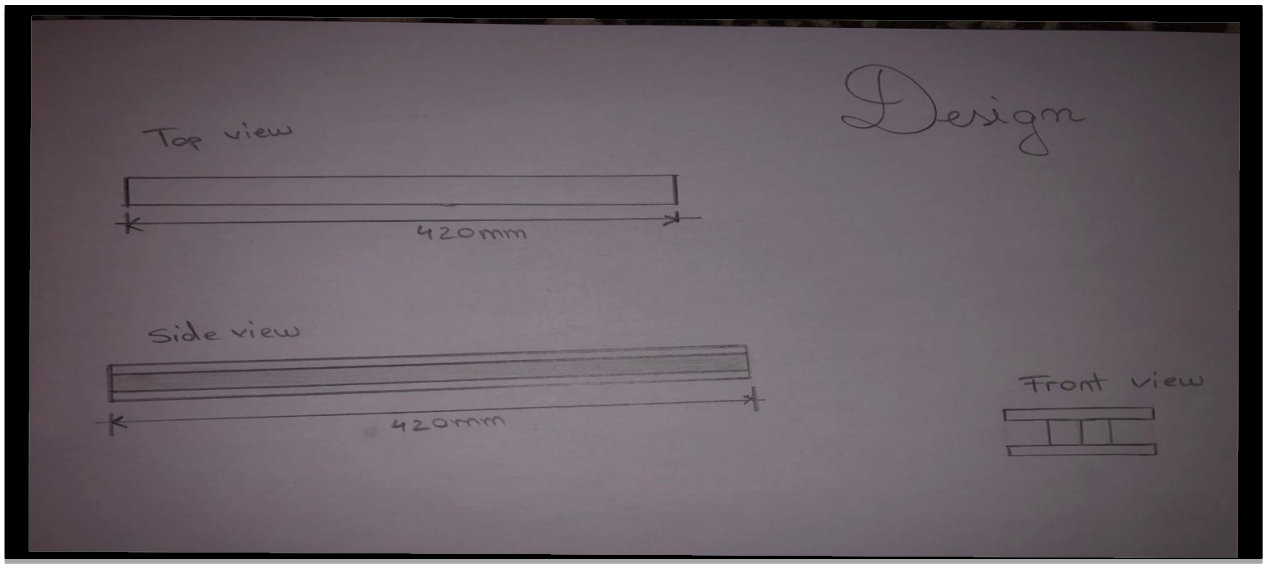
The main aim of this report is to design a beam structure from balsa wood that would carry the equivalent of a central mass of 2.5 kg over a clean span of 400mm. Moving on; the beam must deflect in the range that is specified which is 1.0mm<x<6.5mm with a height of no more than 20 mm. The aim of this report was to develop a beam using minimum volume, moreover, the imposed material restriction.

To come out with a perfect design there is important skills which we need to include during the construction of the beam such as teamwork, design skills, communication skills and fabrication skills. The project enforced three members to enlighten themselves with each other; in addition to that, it helps determine other's strengths and weaknesses. In fact this lab work required the team to work together in fabricating the beam.

Eventually, this task required what many competent engineers encounter on a daily basis, this includes: designing structures, communicating, designing, and creating something useful and relevant using fundamental laws of nature.

BRAINSTORMING AND RATIONALE:

Design



This was design our group have decided on. We used two balsa rectangular sections which we cut into the dimensions of 420x0.5x0.5. We had to do this operation twice to create the top and bottom pieces we needed to create our beam. Also, we cut another two pieces into the same dimensions of 420x0.5x0.5. These two balsa rectangular sections were glued and placed vertically centered between the top and the bottom to the balsa

sheets we previously cut. We assumed that this would be the perfect support for the weight while using lightest materials. The restriction we had in doing our experiment was in dimensions: the length had to be 400<L<450(mm), width of<25 mm and thickness of <25 mm.

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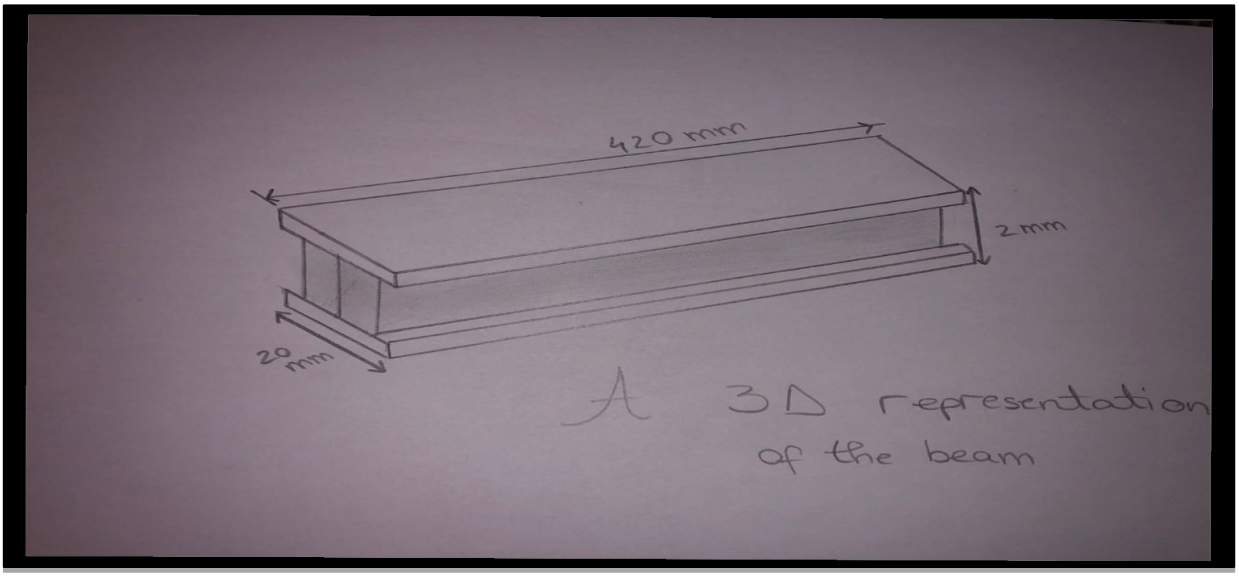


Rational for chosen concept:

- Our design increased the stiffness of the balsa sheet unlike the other designs we could have chosen where the beam could have been weak, and it could have easily broken, and with this design we can have a suitable deflection.
- While projecting our beam we made sure that the glue is placed in the right amount to prevent the pieces of balsa wood from moving or breaking and also we made sure that all the pieces are aligned with each other.

- Our beam should be able to support the weights during testing without breaking.
- The materials we have used would be very simple and adequate to produce and the design would be stress-free to fabricate.

Our chosen design

Before choosing this design, we took into consideration some of the factors that we had in hand, the factors were as follows:

- The type of material that we were provided with was something that had to be taken into consideration, it had a weak structure, so we knew we would have to use more than one layer to create a stronger structure. We decided to design an "I" beam using one balsa sheet (921x80x0.5), and 2 rods of (0.5x0.5x420).
- Dimensions of the material provided: the materials provided has specific dimensions which have guided our design. Even though we were dealing with specific dimensions we managed to come up with a design that could work out.
- The deflection limit was set to 1.0mm<x<6.5mm. We had the set limit into consideration when designing out beam, so we could brainstorm how to achieve a more rigid beam.

DESCRIPTION OF BEAM:

To begin with, we cut the balsa sheet we were provided into dimensions of 420x20x0.5 and we did that twice to create the top and bottom pieces. Secondly, we cut another 2 pieces into dimensions of 420x0.5x0.5 and placed them vertically centered between the top and bottom sheets. The reason we came up with these dimensions is because we were restricted to a length of 400<L<450 (mm), a width of <25mm and thickness of <25mm. We glued the rectangular pieces together after we noted where the center would be to create our "I" beam. The reason for this is that we believed having a more reinforced center would result in extra strength.

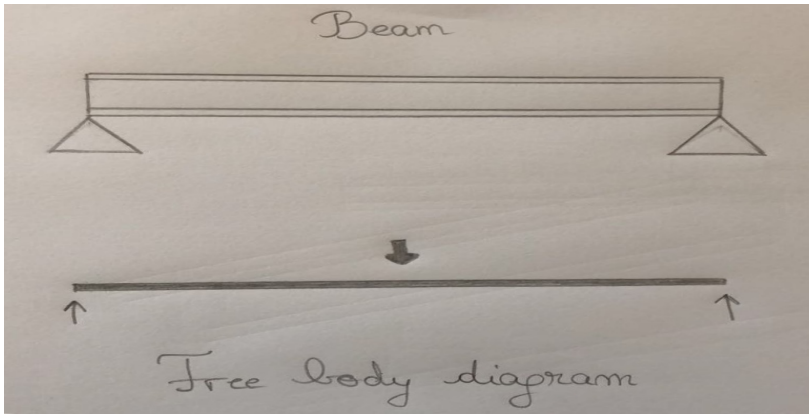
A picture of the beam described:

Front view

Side view

Top view

Free Body Diagram of the beam



Outcomes / Results

Team	Type (Beam/Plank)	Deflection 1.0<x<6.5 mm	Met Criteria (Y/N)	Material Used	Volume (mm^3)	Fabrication Effort (H/L/M)	Comment/ Description
A	Beam	3.36	Y	Balsa wood	105,000	M	Deflection met criteria.
B	Beam	3.1	Y	Balsa wood	108,000	M	Deflection met criteria.
C	Beam	4.0	Y	Balsa wood	137,000	M	Deflection met criteria.

After viewing the results carefully and thoroughly it has been observed that constructing the beam in different ways worked for every group even though there was a different deflection.

The limit of the deflection for all 3 groups was between 3 mm<x<4 mm and none exceeded 4 mm which shows that all the beams that has been constructed were flexible. (Group C) had the highest deflection of 4.0 mm which shows that their beam was flexible. (Group B) had the lowest deflection of 3.1 mm which shows that their beam was slightly flexible. Our group on the other hand (Group A), had a deflection of 3.36 mm which was the most flexible. Looking at the volumes, all the groups got volumes that are different than each other and we can confirm from the table the volume did not relate to the deflection that took place.

Comparing the results of our group to others is suitable. We were convinced about the way we had designed the beam because after we have designed it we clearly noticed that it wouldn’t fracture. We, however, have designed it in a way in where it will have a good deflection. This truly gives an indication that our design was perfect.

Reflection

Fabrication and design of the beam

Looking at the fabrication and design of our group we can say that the design was perfect due to the success of designing the beam properly from the first time. Furthermore, it was effective as it deflected.

Design

The way we have designed the beam is well explained in the brainstorming part and the beam design part of the report.

Ways to improve the design in the second attempt

- Because our beam was flexible, and we ended up choosing the right dimensions, it clearly shows that the beam gave us a good deflection. So, if we were given a second attempt to fabricate and design our beam, we will mainly focus on the ability of the beam if it can withstand up to 2.5 kg of load and see if it will give us an effective deflection. But all in all, there is nothing for now that we need to improve, unless if there is conflict with constructing and fabricating the beam which will significantly lead to getting a lower deflection.

Fabrication

When it came to the fabrication part, our group did not find a lot challenges and we worked as a team each member of our group had a part to do. Mohamed took the appropriate measurements and outlined the parts the needed to be cut while Daniel used the craft knife to cut out the outlined measurements when it came to assemble the pieces together. Eva used the glue which was challenging, and it took a bit of time but at the end we managed to assemble them together.

Some of the challenges that we faced is cutting, it was a bit difficult to follow a straight line even though we have marked it with a pencil. But in the end, we managed to get all pieces with the same measurements. Not only that but when it came to glue it was kind of difficult to estimate the amount of the glue that we had to use, so we later after the tiny mistake we have done, had to use less glue in each of the parts that we wanted to assemble. Even though we faced these challenges, we still managed to assemble it and make it flexible and have it deflected.

Ways to improve the fabrication in the second attempt

- When cutting out in the second attempt we are going to place a ruler which will ensure that we will cut the pieces in a straight and an appropriate way. However we will also make sure that we have time to practice this technique.
- In the second attempt we will ensure that we reduce the amount of the glue that we use so that it will be easier for us to assemble the parts together in a more efficient. Using the glue gun is not easy and needs a person that's have had an experience using it, so we are going to make sure that we put in time in order to practice and get the hand of it.

Performance of the beam relative to the other groups

The main aim of this exercise was firstly to make the beam deflect in the required range of 1.0mm but less than 6.5 mm. All the 3 groups managed to meet the aim of the exercise. Our group easily made it as we got a deflection of 3.36 mm this happened because our team focused on making the beam flexible which seems majority of the groups did the same.

The second aim was also to use the material that each group was provided with and it is been certainly sure that all the groups met this specification whether they used all the material that was provided or less.

Understanding of beam behavior

When we started off by doing our experiment our beam was to be influenced by a contact force which would possibly cause deformation and our main aim was to prevent deformation. Particularly this is a case of a deformable body mechanics in where we have aimed our beam to act in such an elastic way.

Knowledge of beams prior to experiment:

Our group has been clearly setting up the design and fabrication. We have witnessed that the beam has to be stiff, preventing the contact force to deform it significantly. Accordingly, we had to set out a design which would create a stiff beam that would hold the force.

Knowledge gained during the exercise:

Firstly, our knowledge of the strength of the balsa has been significantly improved by getting a sense for the material and moreover by predicting how the force would have influence it. Our team has gained an overall understanding of how to cut, glue, and fabricate a wooden design, in order for us to construct the beam. Eventually after we observed that the force deformed the beam, we have been gaining a better idea of how much force the beam can resist.

Gaps identified:

When we came to construct our project, we have used less amount of materials in our beam, which resulted in getting appropriate results, ensuring that our beam was flexible. We have consumed less materials and that is to realize the importance of design.

How to improve:

So when it comes to the improving part, we should be able to apply calculations understanding to both the influence of forces and the strength and stiffness of the material. Our team will attempt to use fewer materials (in where we have accomplished) and that is to improve the design structure. But all in all, there no major improvements we need to consider.

What literature did you read?

One of the useful sources was discovered in a book named “introduction to engineering analysis”, it granted us a better understandings into the kinds of force, and in addition to that, it helped us explain how they affect the body. This information we have witnessed will be useful in the second attempt as we will start applying some theoretical knowledge and aspects of how different kind of forces work in our beam design.

Team discussion making

The way we got to our final design is by going through stages. Firstly, we thought to ourselves what is a beam? How is it going to deflect? So each member of the group said his opinion about that, after that we brought all the ideas together and we came up with a simple design. Secondly after reviewing the simple design carefully some suggestion from the group members were that the beam would break and we had to make it more complex and effective. After that we have reached to a final design which was successful.

Where we succeeded

- We all worked as one team and our main aim was to produce a final design that would do the purpose.
- Everyone contributed with his idea.
- There were no any conflicts or disagreements between group members.

What we need to improve

- All the designs that were suggested were simple and easy, in the second attempt I think we can improve by using software that can widen our ideas and opportunities to design better beam.
- When it comes to the fabrication we need to be more professional and accurate as this plays a big part for the beam.

Mapping of learning outcomes

1. ***Learning Outcomes covered***

Describe the role of abstraction, simplification and the use of assumptions and mathematical relationships in solving problems encountered by engineers.

How it applied to our team

The balsa experiment was like a real-world problem engineer's encounter. Without much background knowledge we relied upon simplifying the problem to the essential issues and made assumptions on forces and the strength of the materials to help with our planning/design. This outcome was addressed well.

2. ***Learning Outcomes covered***

Analyze simple engineering problems using the fundamental laws of nature, particularly conservation and continuity laws, Newton's laws.

How it applied to our team

The balsa beam was a simple problem that our team thoroughly analyzed. We were limited to a basic understanding of the fundamental laws of nature however this knowledge had a large influence on the project. Newton's laws, the effect of gravity and the effect a force can have on a material influenced our thinking. With an improved knowledge of the fundamental laws of nature and how to apply them both theoretically and mathematically. As a result, this outcome can be addressed better in the future.

3. ***Learning Outcomes covered***

Undertake and present engineering calculations in a professional manner using given formulae.

How it applied to our team

Simple measurements and volume calculations were used in this task, being presented professionally. However, only simple calculations were shown due to the limited knowledge of engineering formulae/calculations. As a group we hope to address this outcome more successfully in the future.

4. ***Learning Outcomes covered***

Demonstrate self-directed learning related to solving problems in one or more engineering disciplines.

How it applied to our team

As a team, roles were assigned and were independently worked on and achieved. Individual roles in both report writing, and fabrication increased the productivity of the group, allowing our individual work to then be combined for a good result. Our team successfully achieved this outcome.

5. Learning Outcomes covered

Reflect on the various roles taken up in teams and the general formal processes required to promote team performance.

How it applied to our team

Our team successfully communicated and assigned roles. We each had a clear understanding of what we had to provide for the group. Constant communication on social networking to share ideas as well as discussions in class and team meetings proved to be extremely helpful in team performance while increasing each other's trust and teamwork which will prove extremely helpful in future tasks. Our team addressed this outcome very well.

Conclusion

This experiment we did together was the first experiment we did together as a group together. We brainstormed a few design ideas until we all agreed on one design based on our general knowledge of structure designs. Working together as teammates was essential as that's how we came up with our design which could be arguably the most successful in terms of deflection compared to the other groups who were also running the same experiment with their own designs (based on results). Our group performed extraordinarily well on increasing our communication skills between one another throughout this experiment, all it took was time to get used to each other.

The main objective of this project was to achieve a deflection between $1.0mm<x<6.5mm$ using the limited amount of balsa sheets we were provided with to carry a weight of 2.5kg (24.5N). Our group successfully managed to meet the requirements that was asked of us in this experiment. This was not an easy or hard task to complete, it was just time consuming considering how much brainstorming we did before agreeing on a design.

Finally, the report was very successful considering we were the group to come up with the design that had the lowest volume and the best deflection value in consideration to that volume. We worked hard together during the meetings we had in the library through our strong communication skills and intelligence. Overall, we are happy with our results taking everything into consideration and are convinced we had the best design between all the groups but still could come up with better designs if we ever got a second attempt at this experiment.

Reference

Wheway, B. 2014. A Guide to Writing an Engineering Report. [e-book] https://eis.uow.edu.au/content/groups/public/@web/@eng/documents/doc/uow061327.pdf [Accessed: 12 Mar 2014].

Appendix A

MEETING MINUTES: Team Meeting #1

Date: 04/10/2018

Time: 11:30 – 14:30
Location: UOWD Lab

Meeting called by: Mohamed Emam

Type of meeting: Brain Storming & Project Commencement

Agenda item: Beam Design Project

Attendees: Mohamed Emam /Daniel Wazz/Eva Barbulescu

Minutes

Action Items	***Person Responsible***	***Action Date***
Concept Design discussed and agreed	NM/MA	04/10/2018
Materials required for construction to be ordered	NM/MA	04/10/2018
Beam to be constructed	NM/MA	04/10/2018
Beam to be tested	Faculty	04/10/2018
Report to be prepared	NM/MA	04/10/2018

MEETING MINUTES: Team Meeting #2

Date: 07/10/2018

Time: 08:30 – 10:30
Location: UOWD Campus

Meeting called by: Daniel Wazz

Type of meeting: Report Preparation

Attendees:
Mohamed Emam /Daniel Wazz/Eva Barbulescu

Minutes

Agenda item:
Beam Design Project Report

Action Items	***Person Responsible***	***Action Date***
Assignment of sections of the	NM/MA	07/10/2018

Appendix B

ENGG102 Fundamentals of Engineering Mechanics

UNIVERSITY OF WOLLONGONG IN DUBAI

ATTACHMENT 1:

Project 1 Attempt A Balsa beam design and test

TEAM ATTENDANCE FORM –
Make a copy of the information for each group member

Tutorial day: 27 Sep 2018 Time: 2:30 Room: 102 Tutorial number: 1

Tutors name:

Team letter: 27 Sep 2018 Name Email address Phone No. Best day for group meeting

Team members: 1. Eva Barbulescu

2. Daniel Wazz

3. Mohamed Emam

Date, time and place of first team meeting to develop the report.: 04/10/2018

Actions list and person responsible:

Project 1 Attempt A Balsa beam design and test

TEAM ATTENDANCE FORM

Tutorial day: 27 Sep 2018 Time: 2:30 Room: 102 Tutorial number: 1

Tutors name: Mustafa Ahmed

Team number: 1 Name Email address Phone No. Best day for group meeting

Team members: 1. Eva Barbulescu

2. Daniel Wazz

3. Mohamed Emam

Date, time and place of first team meeting to develop the report.: 4 Oct 2018

Project 1 Attempt A Balsa beam design and test

TEAM ATTENDANCE FORM

Tutorial day: 27 Sep 2018 Time: 2:30 Room: 102 Tutorial number: 1

Tutors name: Mustafa Ahmed

Team number: Name Email address Phone No. Best day for group meeting

Team members: 1. Eva Barbulescu

2. Daniel Wazz

3. Mohamed Emam

Date, time and place of first team meeting to develop the report.: 4 Oct 2018

UNIVERSITY OF WOLLONGONG IN DUBAI
Faculty of Engineering and Information Sciences

ATTACHMENT 2:

Material Request List (complete and give to your tutor)

Task 4: Project 1A: Beam Design - Building

Tutorial Number 1 **Team Number** A **Tutor's Name** Mustafa Ahmed **Date** 27th Sep 2018

Please supply the following Balsa Beam construction materials -

1. Balsa Sheet

Section dimensions and length - L = 420 mm
Quantity - x2

2. Balsa rectangular Sections

Section dimensions and length - 420 x 20 x 2
Quantity - x2

Section dimensions and length - 420 x 0.5 x 0.5
Quantity - x2

Section dimensions and length - ////////
Quantity - ////////

Materials collected by - Tutor

Please note -

1. Material supplies are limited so please do not delay in collecting your order.
2. It is your responsibility to choose your materials wisely. Returns or refunds will not be considered.
3. Replacements for breakages and any additional Material Requests will be considered only at the discretion of the management.

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ATTACHMENT 4:

ENGG102 Team Ground Rules and Contract Form

For a team to be effective it is a requirement that all team members understand their responsibilities to one another. It can be useful to discuss and agree certain project ground rules.

All team members agree to -

1. Come to class and team meetings on time.
2. Come to meetings with assignments and other necessary preparations done.
3. Respect one another.
4. Help each other when the need arises.

Additional Rules -

5. complete your parts of the assignment on time

6.

7.

If a team member fails to meet these ground rules, other members are expected to take the following actions -

Step 1: (agree action amongst the team and write it here)

Talk to the tutor about the situation

If not resolved -

Step 2: Bring the issue to the attention of tutor
Agree with tutor, actions to be taken -

If still not resolved -

Step 3: Meet as a group with your Tutor and if necessary your Subject coordinator.

Tutorial Number: 1 Team: 1

Member signatures:

1.

2.

3.