COURSE PROJECT

2020-2021

Course Project Guidelines

Mechanics of Materials

ME 323

25%

Semester: Fall 2020-2021

Contents

I. Introduction

This project is intended to demonstrate students' ability to analyse all forms of stresses and deformations in a structure. They have to carry out analysis to determine the type of stress generated in different structure members and calculate the value of these stresses. They will also be able to select the suitable material for a given member under service. In addition to applying technical knowledge in a 'real world' project, this would demonstrate the students' ability to conduct group research, teamwork, technical data interpretation, software use, report writing and project management skills.

Accordingly, students are required to formulate groups of 3 members.

ABET STUDENT Outcome measurement: The following outcome shall be measured in the current semester across the 3 deliverables
SO (5) - An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
The students should note that grades are not allotted for each of the below points, rather they should demonstrate all the points as per the requirements of each deliverable. Students should only follow the guidelines of each deliverable for writing reports/presentations.

5.1	Demonstrate leadership and professional behavior in teams	Project Deliverable 1
5.2	Build-up and function in collaborative and inclusive environment.	Project Deliverable 3
5.3	Establish goals and plan tasks to meet the objectives of the team	Project Deliverable 1
5.4	Contribute to the execution of plans to meet objectives of the team.	Project Deliverable 2

II. Learning Outcomes

The project covers all learning outcomes described in the course syllabus (Refer to the syllabus for more details) and concentrate mainly in the application of the following experiences:

- Develop an understanding of structures subject to all type of loading (1)
- Foster effective mathematical and graphical communication skills (3)
- Function on teams (5)

III. Project Summary (Scenario)

You are asked to study and analyze the body-building equipment shown in figure 1 (body-solid bicep/tricep machine). Your objective is to apply stress and deformation analysis to evaluate the maximum stress, deformation and the factor of safety in the main metallic arm ABCDEF (Figure 2), within the elastic domain, if the weight lifted by the machine is equal to 100 kg.

Consider all rectangular hollow sections (BC & DE) as *60 × 40 × 2.9 mm* and the circular hollow section (AB) having an outer diameter of *50 mm* and a wall thickness of *5 mm.* A *12 mm* diameter pin is used at point *P*. To succeed your mission you should apply stress and deformation analysis to the steel arm, as mentioned in Deliverable 2.

Deliverable 1:

1. Select a team leader and conduct a meeting with all the team members
2. Prepare a minutes of meeting (MOM) covering all the issues discussed in the meeting including but not limited to the following points-
    - Function of Team leader and team members
    - Prepare a Gantt chart describing all the further work that needs to be done to complete the study – a detailed Work plan.
    - Other project management issues including plan for periodic team meetings

Figure 1: body-solid bicep/tricep machine

Deliverable 2:

1. Describe the problem without addressing any possible solutions – Problem definition.
2. Conduct research to complete properly any missing data or dimension and draw the sketch of the Steel Arm ABCDEF.
3. Create a simplified line diagram of the arm indicating different forces and moments.
4. Define the maximum force that the athlete can apply at both handles.
5. Conduct research and gather information to determine the materials used in the arm.

   Show the properties of the selected material in a table.

6. Consider the structure as fixed at portion *EF* and apply required stress analysis at the design critical points by determining in all members:
   a. the average normal stress due to axial loading if applicable,
   b. the average shearing stress due to transverse loading if applicable,

c. the maximum shearing stress due to the torsional load if applicable,

d. the maximum stresses due to the bending behavior if applicable.

7. Select the maximum normal (can be bending stress) and shear stresses.
8. Calculate the factor of safety of the machine.
9. Calculate the deflection at *A. (if the chapter is covered in class)*
10. Explain how individual members have contributed as per Gantt Chart in Del 1.

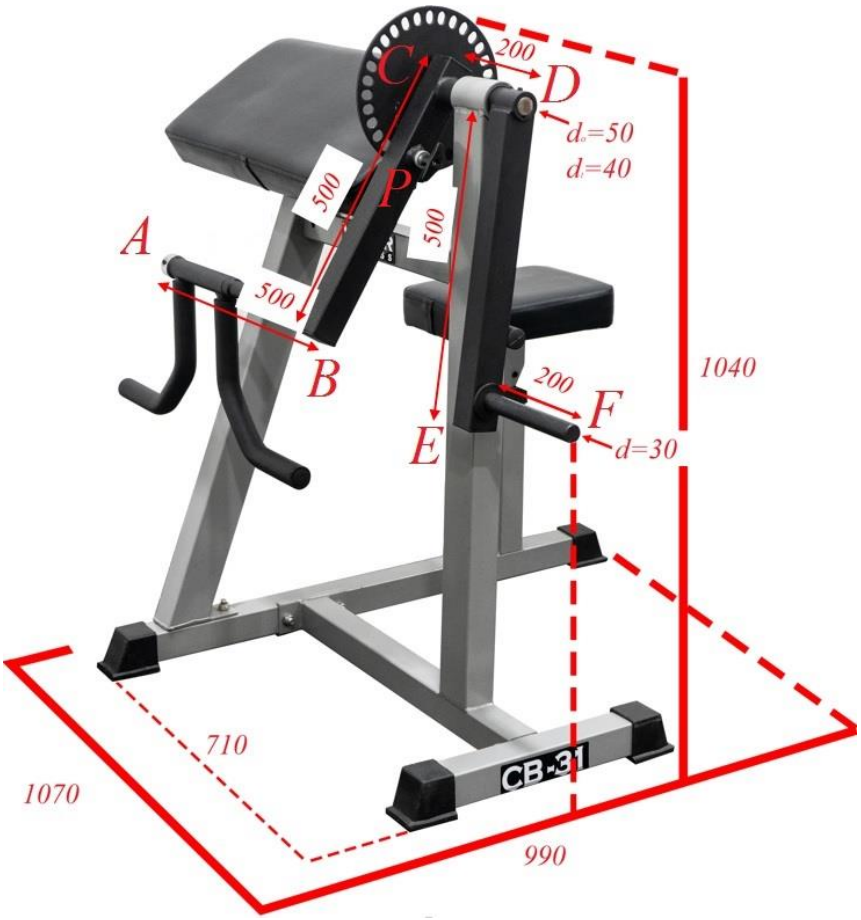

Figure 2: Machine Dimensions (All dimension are given in mm).

Deliverable 3:

1. A Powerpoint presentation of the Del2 – each member to reflect their own contribution and how they have collaborated with team members.

IV. Deliverables & Project Management

Deliverables		Deadline	Method of Delivery	Grade Allocated
D1 (OCA 3A)	Groups of 3 students should be formed with one team leader and names submitted to the instructor. A Minutes of Meeting covering points listed in Deliverable 1	**Dec. 15th 2020**	Upload the minutes of meeting	**2.5%**
D2 (OCA 3B)	Analysis of stresses and deformations taking place in the beam, highlighting the points of maximum stresses and the factor of safety.	**Jan 26th 2020**	Upload the final report **(typed in word document / handwritten equations)** on Moodle on the specified link	**12.5%**
D3 (OCA 4)	A short PowerPoint presentation (5 minutes maximum) describing your work.	**Jan 31st 2020**	Upload the Power-Point presentation on Moodle and individual in class discussion during W15	**10%**
			Total	**25%**

V. Plagiarism

- Upon suspicion and doubt of the authenticity of the work submitted, the Instructor has the right to ask the student to verify her/his work. This can be done through, but not limited to, oral examination or discussion, or any other action deemed necessary. If the student fails to prove the authenticity of the work, then the Instructor will apply the academic misconduct rules as mentioned in the AUM Student Handbook which may include awarding the work a zero grade.
- You will also be held responsible if someone else copies your work - unless you can demonstrate that you have taken reasonable precautions against copying.
- For a detailed description of academic misconduct please refer to the undergraduate AUM Student Handbook.

VI. Marking Scheme

Deliverables	90-100%	80-90%	70-80%	60-70%
D1	Well written initial report includes all elements	Initial report includes all items but lacks clarity	Initial report lacks clarity and missing one element	Initial report lacks clarity and missing two items
	90-100%	90-80%	60-80%	
D2	Outstanding study and a full design report which includes all elements	Satisfactorily written report includes all elements	Poorly written report includes some of the elements	
	90-100%	90-80%	60-80%	
D3	Excellent presentation, answered all questions	Satisfactory presentation , answered most questions	Weak presentation, answered few/no questions	
Project Total	25% of course total			