1E10 ENGINEERING DESIGN II: PROJECT [10 credits]

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Module organisation
This module runs for the first half (11 weeks) of the academic year and comprises of one lecture per week together with eleven three-hour laboratories (total of 44 hours contact time).

Module description, aims and contribution to programme
- to develop design skills according to a Conceive-Design-Implement-Operate (CDIO) compliant methodology;
- to apply engineering sciences through learning-by-doing project work;
- to provide a framework to encourage creativity and innovation;
- to develop team work and communication skills through group-based activity;
- to foster self-directing learning and critical evaluation.

Learning outcomes
Upon completion of this module, students will be able to:
1. Model trajectories of masses with and without aerodynamic drag.
2. Develop a software tool to allow trajectories be optimised.
3. Analyse the static and dynamic stresses of elements of an engineering mechanism.
4. Optimally design structural elements of an engineering mechanism.
5. Perform a test to acquire an engineering material property.
6. Develop and test software code to process sensor data.
7. Design and construct and test an electronic hardware solution to process sensor data.
8. Construct a Roman catapult “Mangonel” using tools, materials and assembly instructions.
9. Operate and evaluate the “Mangonel” for functional and structural performance.
10. Validate theoretical models by comparison with experiments.
11. Integrate skills to innovatively redesign an element of the “Mangonel”.
12. Participate and cooperate in a team.
Module content
Groups of students will work together on assignments in the areas of Mechanical and Manufacturing Engineering; Electronic and Electrical Engineering; and Civil, Structural and Environmental Engineering. The assignments will facilitate the design, construction and analysis of a Mangonel. In addition to some introductory lectures, the content of the students’ work during the year will consist of:

- the construction of a Mangonel;
- the development of a software tool to allow the trajectory of a “missile” to be studied as a function of various operating parameters;
- a structural analysis of certain key components of the Mangonel for static and dynamic stresses using values of material properties which will be experimentally determined;
- the development of a micro-electronic system to allow the angular velocity of the throwing arm to be determined;
- testing the Mangonel;
- redesigning the throwing arm of the Mangonel to optimise for distance without compromising its structural integrity;
- an inter-group competition at the end of the year.

Teaching strategies
This module is delivered using a combination of introductory lectures and participation by the students in 12 “activities”. The activities are executed to support the syllabus of the course and might take place in specialised laboratories or on the rugby pitch. This module is structured using Blackboard. Students work in groups throughout the year to encourage teamwork, cooperation and to avail of the different skills of its members.

Associated laboratory/project programme

<table>
<thead>
<tr>
<th>Laboratory Title</th>
<th>Code</th>
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<tbody>
<tr>
<td>Dynamics of Mangonel - No Drag</td>
<td>L1</td>
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<tr>
<td>Dynamics of Mangonel - With Drag</td>
<td>L2</td>
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<tr>
<td>Design against failure under static actions</td>
<td>L3</td>
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<tr>
<td>Design against failure under dynamic actions</td>
<td>L4</td>
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<td>Arduino Introduction</td>
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<td>Software 1</td>
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<td>Hardware 1</td>
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<tr>
<td>Software 2</td>
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<td>Hardware 2</td>
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<td>Assembly of Mangonel</td>
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<td>Mangonel redesign for competition</td>
<td>L11</td>
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<tr>
<td>Competition</td>
<td>L12</td>
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Assessment
This module is assessed entirely through continuous assessment based on five individual assignments, two group based assignments and two individual online multiple choice assessments. There will be no exam in the examination period. As 1E10 is assessed entirely on project work taken during the year, and as the course counts for 10ECTS, students who do not pass this module will be required to repeat the year in full.

Important note
As the module is evaluated fully through continuous assessment, there are no formal examinations. Therefore, there are no associated supplemental examinations which can be taken if the module is failed. Similarly, it is not possible to complete work over the summer individually as an alternative to examinations. This is due to the group work nature of the module. As this module counts for 10 credits, you will have to repeat the year if you fail this module.

Further information
Blackboard course:  https://tcd.blackboard.com/.........ME1E10