

## 2E10 ENGINEERING DESIGN IV: PROJECT [10 credits]

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### Module organisation

This module runs throughout the first semester consisting of a lecture together with two two-hour laboratories each week (total contact time of 55 hours).

### Module description, aims and contribution to programme

The 2E10 Engineering Design IV module introduces the challenge of electronic systems design. The project is an example of 'hardware and software co-design' and the scale of the task is such that it requires teamwork and a co-ordinated effort. Each group has access to the basic shell of a vehicle that includes the motor assemblies, battery holders and sensors. The completed system should comprise of a computer controlled autonomous vehicle with motor driven wheels and position sensors. The motors and the position sensors should operate under control from a programmable microcontroller and the vehicle should communicate with a base station using a Zigbee standard wireless module.

The objectives of this module are:

- to apply basic principles of science and engineering to Conceive, Design, Implement and Operate (CDIO) an autonomous vehicle;
- to introduce group working and project planning;
- to introduce the principles of circuit construction and the health and safety issues associated with electronic circuit construction and the adoption of test procedures;
- to introduce the principles of software systems design including user interface design and control software for wireless communications;
- to analyse the design and optimise it with respect to manufacturability and testing;
- to introduce the requirements of project documentation, circuit drawings and software documentation;
- to introduce project reporting and presentation.

### Learning outcomes

Upon completion of this module, students will (be able to):

- have a knowledge of the engineering process of problem solving;
- to design a simple autonomous vehicle to meet a well-defined specification;
- have acquired knowledge of group working including task sub-division and coordinated meeting of interim deliverables;

- have acquired a knowledge of the health and safety requirements of electronic circuit board construction;
- have a knowledge of the issues to be addressed in a combined hardware and software system design;
- have developed skills in the areas of quantitative analysis, scientific reasoning and communication;
- have developed practical experimental skills in electronic circuit testing;
- have developed practical experimental skills in software system testing;
- have a knowledge of the requirements of report writing and project documentation.

### **Teaching strategies**

The module is taught using a combination of lectures, demonstration laboratories and through project sessions at which advisors are present. The groups are also expected to undertake independent research and development work on the project.

### **Assessment**

The project is assessed through a combination of (i) interim reports both individual and group (ii) a presentation by each group to a panel who will examine the quality of the autonomous vehicle and its operation (iii) the submission of a final group report. The allocation of marks across these components is as follows: interim submissions (40%); group buggy demonstration, system inspection and oral assessment (30%) and final report (30%).

NOTE: THERE IS NO ANNUAL EXAMINATION IN THIS MODULE. IF A PASS MARK IS **NOT** ACHIEVED AN INDIVIDUAL SUPPLEMENTARY EXERCISE WILL BE PRESCRIBED.

### **Further information**

<http://www.tcd.ie/Engineering/undergraduate/baiyear2/2E10>