Engineering Tripos Part IIA Project, GA3: Heat Exchanger, 2018-19

Leader

Dr J P Longley [1]

Timing and Structure

Fridays 9-11am plus afternoons, and Tuesdays 11-1pm

Prerequisites

None

Aims

The aims of the course are to:

- To introduce you to the basic principles of heat exchanger design.
- To compare predicted with actual performance and hence understand the limitations of heat transfer correlations.
- To give you experience in the production of workshop drawings and the problems of manufacture and assembly to such drawings.
- To demonstrate that different 'optimal' designs can arise from the same brief.

Content

Heat exchangers are found virtually everywhere, from domestic heaters to exotic space applications. This project involves the design, construction and testing of a small shell-and-tube heat exchanger. It spans the whole process of product development, from the conception and sizing using basic theory, to the manufacturing, assembly, and final testing.

Students will work in groups of two to undetake the initial design. The groups will then be paired, into groups of four. The four will then finalise the choice of design. The interim repot will describe both the initial pairs design and the final group of fours design. The interim report will include the theory and drawings and carries a large proportion of the total marks.

Thi sproject is front-end loaded. Weeks 1 and 2 require a lot of work. Weeks 3 and 4 are light.

Week 1

At the start of the project you will learn about the fundamentals of heat exchangers, using a poorly-designed heat exchanger as an example. You will develop your own computer-based design tool, which you will use to select an optimal configuration. The Majority of groups use Matlab, although some have usesd Excel and Python. Prior experience with Matlab, Excel or Python is therefore beneficial.

Week 2

In the second week, you will refine your design in line with the workshop's manufacturing capabilities and your assembly capabilities. Clever engineering at this stage can greatly simplify assembly and improve off-design performance. At the end of the week you will produce detailed manufacturing drawings and an interim report.

Week 3

In the third week you will work out the off-design performance of your heat exchanger and use your computer-based design tool to assess other groups' designs. This feeds into your final reports. Meanwhile, the workshops will be machining parts to your manufacturing drawings and commenting on your designs.

Week 4

In the final week you will assemble your heat exchangers. On test day, all groups test their heat exchangers together. The project finishes with a comparison of all heat exchangers and a glamorous prize ceremony.

MINI-LECTURES Week 1

Review of relevant heat transfer principles, shell-and-tube heat exchanger design.

MINI-LECTURES Week 2

Use of computer simulation package, discussion of students designs.

Coursework

Coursework	Due date	Marks
Interim report		30 (Group of 4: 80% individ
Performance Report		10 (Group of 4: 80% indivic
Final Report		10 (Group of 4: 80% indivic
Project skills, technical skills and initiative		20 (60% individual 40% gro
Final machine performance		10 (100% Group)

Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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[1] mailto:jpl1000@cam.ac.uk
[2] https://teaching24-25.eng.cam.ac.uk/content/form-conduct-examinations