Engineering Tripos Part IIA Project, GA4: Heat Pump, 2022-23

Leader

Dr A J White [1]

Timing and Structure

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

Prerequisites

3A5 useful

Aims

The aims of the course are to:

- To critically assess the value of heat pump technology as a way of reducing emissions of CO2.
- Design an experiment to measure the performance of a heat pump, and to make performance measurements.
- Produce a Python model of the heat pump which is validated against the experimental measurements.
- Model and understand how an Air Source Heat Pump (ASHP) operating in a typical house over the course of a year.

Content

The descriptions below and the lists of tasks / reports are based on the 2022 project and may be modified slightly for the coming year

This project looks at the performance of a commercially available heat pump for domestic heating applications. Students will be required to modify and design some instrumentation and undertake experiments to measure the performance of a commercial heat pump. They will also create a Python model of the heat pump cycle. Either the Python model or information extracted from the exeperiments can then be used to model how an Air Source Heat Pump will perform over the course of a year for heating a typical dwelling, taking account of weather variations.

Students will work in groups of 4 to modify the heat pump rig, design and calibrate some instrumentation and perform the experiments. Individual tasks may be distributed amongst group members as decided by the group. The first report is a group report (6 pages) and the final report (8 pages) is to be written individually. Students also submit their Python script individually and this will be tested and marked.

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Weeks 1 & 2

- Familiarisation with the equipment.
- Design, build and calibration of flow measurement device.
- Writing data processing code in Python
- Commence Python thermodynamic cycle model
- Undertake heat pump measurements
- **Submit group report on experimental work**

Weeks 3 & 4

- **Complete and submit Python model of heat pump cycle (individually)**
- As a group, develop a model of a heat-pump system - including the the dwelling
- As a group, undertake calculations of how a heat pump performs over a typical year
- Undertake (primarily individually) some further investigation, which may be experimental, modelling or literature based.
- **Submit individual final report**

Coursework

Coursework	Due date	Marks
Interim Report 1 (group)	**TBC** (End of week 2)	25 (group)
Submission of Python script (individual)	**TBC** (Middle of week 3)	15 (individual)
Final Report (individual but with some group components)	**Friday 9 June 2023**	40 (individual)

Examination Guidelines

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

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Links
[1] mailto:ajw36@cam.ac.uk
[2] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations