EMS623 Heat Exchange and Waste Minimisation

Individual design project: Heat Exchanger Design

The Problem

The Figure below shows part of an air-conditioning plant. In order to replace stale air in an office block, 90 m^3/min of air is discharged to the outside and replaced by an equal amount drawn into the building.

To save on the cost of heating this cold air a “run-around” system is installed to use heat from the discharged air to pre-heat the fresh air.

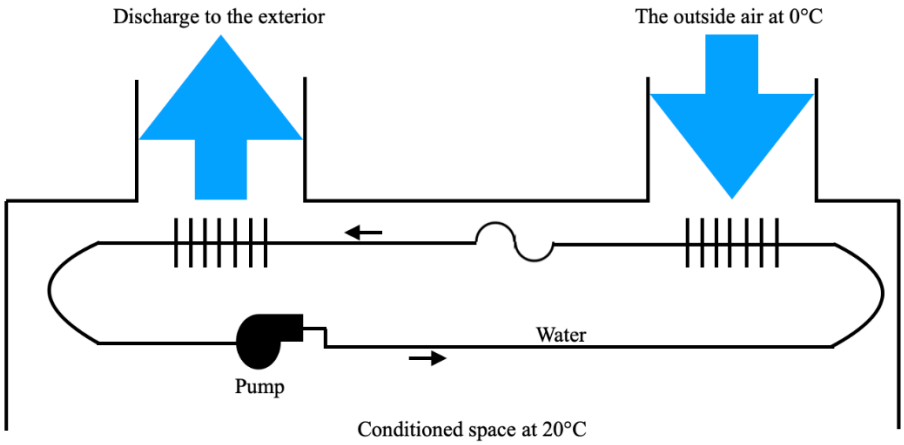
The system works on water flowing through the pipes which form two finned tube heat exchangers, one to extract heat from the outgoing air and the other to preheat the incoming air. The total heat transfer from one air stream to the other is 10 kW and it can be assumed that the pipes connecting the two heat exchangers are perfectly insulated.

Determine a suitable geometry and size for the heat exchanger on the discharge side using a shell and tube heat exchanger with fins on the air side of the tubes.

You will need to make reasonable assumptions about the flow rate of water and its temperature rise while passing through the heat exchanger.

You will also need to make realistic estimates of the inside and outside heat-transfer coefficients for the exchangers in order to calculate their overall heat-transfer coeffcients.

Marks will be awarded for full explanation of your methodology, justification of all assumptions and full referencing of all data sources.



Deadlines and Page Limit

Hand in by 23:55, 31 October 2025 (Friday of Week A6)

Electronic Submission via QMplus

1. PDF files only.
2. 6 pages maximum for the main body, including everything but the sample calculation and title page (figures, equations, text and references).
3. 3 pages maximum for the Appendix (sample calculation only).
4. Ariel font with minimum size 11 & adequate spacing.

In addition to the usual late penalties, 5% will be deducted for each of 1 to 4 above not adhered to.

In addition to the 9 pages above (6 for main body, 3 for sample calculation) you should also include a title page with the usual information (module name and code, coursework title, your name and student number).

Report Format and Marking Scheme

Title page 1 page

Main Body Maximum 6 pages

Introduction

This should briefly restate the problem and describe the approach to solving it.

Maximum 1 page, 10% of total marks

Methodology

Describes in detail the method adopted to solve the problem, including all equations used, with references where appropriate.

Maximum 1.5 pages, 30% of total marks

Results

Describe and discuss the results of your investigation. This should include full dimensions of your best designs for both the simple counter flow “tube in tube” exchanger and the shell and tube heat exchanger with comparisons to other less successful geometries and some discussion about why some designs worked better than others did.

Maximum 2 pages, 30% of total marks

Conclusions and References

Summarise the main conclusions and suggest how the design might be further refined. List all your sources. Use either Harvard (name and date) or Vancouver (numbering).

Maximum 1.5 page, 10% of total marks

Appendix – Sample calculation

Give full working calculations for your single best design.

Maximum 3 pages, 20% of total marks