WM368-15 Advanced Thermodynamics

23/24

Department
WMG
Level
Undergraduate Level 3
Module leader
Jane Rayner
Credit value
15
Module duration
12 weeks
Assessment
Multiple
Study location
Dyson Institute of Technology, Malmesbury

Description

Introductory description

The module incorporates three components of thermodynamic sciences – heat transfer from fins, advanced thermodynamic cycles and mass transfer involving evaporation.

Module web page

Module aims

The overall module aim is to develop the abilities to understand, model and analyse advanced thermodynamics theories and systems and apply these to engineering systems. The module incorporates three components of thermodynamic sciences – heat transfer from fins, advanced thermodynamic cycles and mass transfer. The heat transfer from the fin component will include the introduction of the fin equation and the application of the fin equation to engineering problems. The advanced thermodynamic cycles component will include the analysis of real power heating and cooling systems using thermodynamic principles. The mass transfer element will include the application of mass transfer theories to evaporation.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Heat transfer from fins

- the fin equation
- fin efficiency
- analysis of common fin configurations
- heat transfer from fins of variable cross section
  Advanced thermodynamic cycles
- recap of PV and TS diagrams
- isentropic and polytropic efficiency
- analysis of power generation cycles including, Carnot, Otto, Diesel, Brayton and Rankine
- analysis of refrigeration cycles
  Mass transfer
- mass diffusion
- heat & mass transfer
- convective mass transfer
- humidity
- drying

Learning outcomes

By the end of the module, students should be able to:

- Devise a temperature profile for a cooling fin given different boundary conditions using an appropriate method
- Critically evaluate the performance of dehumidification systems.
- Construct appropriate Pressure-Volume and Temperature-Entropy diagrams for a variety of complex thermodynamic cycles.
- Solve complex problems involving heat and mass transfer.

Indicative reading list

1. Y.A. Cengel, J.M. Cimbala, R.H. Turner: “Fundamentals of Thermal-Fluid Sciences (SI Units)”, 5th Edition, (McGraw-Hill) ISBN: 9789814720953 (2017)
2. F.P. Incropera, D.P. DeWitt, T.L. Bergman, A.S. Lavine: “Principles of Heat and Mass Transfer”, 6th Edition, (John Wiley & Sons) ISBN: 9781119382911, (2017)
3. F. Kreith, R.M. Manglik: “Principles of Heat Transfer”, 8th Edition, (Cengage Learning) ISBN: 9781305387102, (2017).

View reading list on Talis Aspire

Subject specific skills

Ability to apply quantitative methods to understand the thermodynamic performance of systems and components.
Technical knowledge and understanding to create or adapt designs solutions that are fit for purpose including operation, maintenance, reliability etc.
Communicate work to technical and non-technical audiences.
Knowledge and understanding of workshop and laboratory practice.

Awareness of team roles and the ability to work as a member of an engineering team.
Effective use of general IT facilities.
Plan and carry out a personal programme of work.
Exercise personal responsibility, which may be as a team member.

Transferable skills

Problem solving,
numeracy skills,
collaborative working,
data analysis,
communication skills,
written communication,
time management,
personal organisation,
listening,
self-motivation,
health and safety awareness.

Study

Study time

Type	Required
Lectures	12 sessions of 1 hour (13%)
Seminars	6 sessions of 1 hour (7%)
Practical classes	1 session of 4 hours (4%)
Private study	68 hours (76%)
Total	90 hours

Private study description

Self-study

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time
Heat Transfer Assignment Group report on: Part 1 - Fin heat transfer, testing and design Part 2 – Mass transfer, evaporation	60%	36 hours
Advanced Thermodynamics Examination	40%	24 hours

Assessment group R1

	Weighting	Study time
Advanced Thermodynamics Examination Advanced Thermodynamics Resit Examination	100%	

Feedback on assessment

Feedback given as appropriate to the assessment type:

- verbal feedback given during seminar/tutorial sessions,
- written individual formative feedback on the assignment report and on the presentation,
- written cohort-level summative feedback on the exam.

Past exam papers for WM368

Availability

Courses

This module is Core for:

- Year 4 of DWMS-H7BH Undergraduate Engineering (Degree Apprenticeship)