PX280-15 Environmental Physics

22/23

Department
Physics
Level
Undergraduate Level 2
Module leader
Michael Pounds
Credit value
15
Module duration
20 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The laws of thermodynamics bound what useful work can be extracted from any source. There are also limits to what we can do to mitigate the effects of the resultant heat and waste products. Understanding which processes are under our control involves interesting physics as well environmental science, chemistry and social sciences.

Module web page

Module aims

To explain how energy is absorbed by, and moved around, the Earth both naturally and as a result of human intervention. The module will look at consequences for the environment of energy use and study electrical power production using core physics already covered in previous modules.

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.

1. Revision of the Carnot cycle and relation to maximum possible efficiency. Energy resources, estimated reserves and current consumption.

2. Power transmission lines, three phase, transformers
3. Power Stations: fossil fuel, nuclear (thermal and fast breeder, reprocessing), fusion (Lawson criteria, design concepts, inertial and magnetic confinement).
4. Climates of the past and prediction of future climate change.
5. The greenhouse effect, radiative forcing, feedbacks, climate sensitivity, and the carbon cycle.
6. Simple climate change economics.

Learning outcomes

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

- Describe how electricity is generated in power stations (fossil fuel, nuclear, fusion-based) and by renewable sources and be able to explain what limits the output in all cases
- Estimate transmission line losses and understand the role of transformers in power distribution
- Describe climates of the past and understand how future climate change can be predicted
- Explain the “greenhouse effect”, radiative forcing, feedbacks, and climate sensitivity
- Understand simple climate change economics

Indicative reading list

Sustainable Energy without the Hot Air, David J C Mackay, UIT, 2009
Environmental Physics, Egbert Boeker and Rienk Van Grondelle, Wiley, 2011
Global Warming, John Houghton, CUP, 2015
Introduction to Modern Climate Change, Andrew Dessler, CUP, 2016

Interdisciplinary

The science of energy sourcing and use, and the techniques used to generate and transmit electrical power, are archetypical "inter-disciplines". There are issues arising from physics, engineering, politics, economics and costs to the environment. This module shows how to compare the efficiency, and economic and enivironmental costs, of how energy is used and of how electricity is generated.

Subject specific skills

Knowledge of mathematics and physics. Skills in modelling, reasoning, thinking.

Transferable skills

Analytical, communication, problem-solving, self-study

Study

Study time

Type	Required
Lectures	40 sessions of 1 hour (27%)
Private study	110 hours (73%)
Total	150 hours

Private study description

Working through lecture notes, solving problems, wider reading, discussing with others taking the module, revising for exam, practising on past exam papers

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

	Weighting	Study time
In-person Examination Answer 4 questions	100%	

- Answerbook Pink (12 page)
- Students may use a calculator

Feedback on assessment

Personal tutor, group feedback

Past exam papers for PX280

Availability

Courses

This module is Option list A for:

- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
  - Year 2 of GF13 Mathematics and Physics
  - Year 2 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
  - Year 2 of FG31 Mathematics and Physics (MMathPhys)
  - Year 2 of FG31 Mathematics and Physics (MMathPhys)
- UPXA-F300 Undergraduate Physics (BSc)
  - Year 2 of F300 Physics
  - Year 2 of F300 Physics
  - Year 2 of F300 Physics
- UPXA-F303 Undergraduate Physics (MPhys)
  - Year 2 of F300 Physics
  - Year 2 of F303 Physics (MPhys)
- UPXA-F3F5 Undergraduate Physics with Astrophysics (BSc)
  - Year 2 of F3F5 Physics with Astrophysics
  - Year 2 of F3F5 Physics with Astrophysics
- Year 2 of UPXA-F3FA Undergraduate Physics with Astrophysics (MPhys)

This module is Option list B for:

- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 2 of G100 Mathematics
  - Year 2 of G103 Mathematics (MMath)
  - Year 2 of G103 Mathematics (MMath)
- Year 2 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year