Aims and Objectives

2B27 Environmental Physics 2003

Provisional Course Summary

This half-unit is designed to illustrate the many aspects of physics that pervade environmental processes in our everyday lives and in naturally occurring phenomena. It will be largely a descriptive course though some basic mathematical skills are necessary to gain a full understanding of some parts of the course. Students taking this course should ideally therefore have a knowledge of basic calculus. Students should also have a basic knowledge of physics to at least 'A' level standard although the course is equally accessible to Physical Science students who have taken the 'Foundations of Physics' courses.

A full Syllabus is attached. This may change from year to year in minor aspects as new subjects are chosen to reflect topical issues in the news.

The course is given in the first Term. The total number of lectures is 33 with two problems classes and two revision classes. However the time division between discussion and lectures is not rigid and some periods may be both lecture and discussion depending on student input. The lecturer will also hand out problem sheets during the Course. These are intended to give the students practice in the kinds of calculations that are likely to come up in the examination at the end of the year but are not themselves assessed. Model solutions will be made available after the problems classes.

Continuous assessment plays an important part of the assessment of this course. 20% of the total marks arise from continuous assessment. 10% of these marks are awarded for performance on three problem sheets. The other 10% are awarded for a single 'long essay (3500 words) written on a topic of the student's choice related to the course with the general theme of 'Environmental Physics'.

A single two and a half hour examination is held in the third Term to evaluate the student's understanding of the taught material. Only material covered in the assigned lectures is examinable.

Course Text Book Environmental Physics; N.J. Mason and P Hughes – Taylor and Francis 2001 (further details below)

Lecturer

Dr J.H. Harding
Room G05b, Kathleen Lonsdale Building
Department of Physics and Astronomy

Telephone: 020 7679 [3]3506
Fax: 020 7679 [3]1360
Email j.harding@ucl.ac.uk

ENVIRONMENTAL PHYSICS (1/2 unit)

Objectives of the course

By the end of this course, a student will be able to

1. Understand the basic composition, structure and dynamics of the atmosphere
2. Explain the workings of the hydrologic cycle and discuss the mechanisms of water transport in the atmosphere and in the ground.
3. Discuss specific environmental problems such as acid rain, ozone depletion and global warming in the context of an overall understanding of the dynamics of the atmosphere.
4. Discuss the problems of energy demand and explain the possible contributions of renewables to energy supply giving at least three specific examples

Detailed syllabus

1. **Structure and composition of the Atmosphere**
   Principal layers, troposphere, stratosphere, mesosphere, thermosphere
   Ideal gas model revisited, exponential variation of pressure with height
   Escape velocity
   Temperature structure and lapse rate

2. **Radiation**
   The Sun as the prime source of energy for the earth
   Solar energy input, cycles daily and annual
   Spectrum of solar radiation reaching the earth
   Total radiation and the Stefan Boltzmann, Wien and Kirchoff Laws
   Radiation balance at the earth's surface and determination of the surface temperature
   Ozone layers and depletion
   CO_2, methane, H_2O and the Greenhouse effect

3. **The hydrosphere**
   Properties of water
   The hydrologic cycle
   Measuring the water content of the atmosphere; humidity.
   Thermodynamics of moist air and cloud formation
   Growth of water droplets in clouds
   Rain and thunderstorms

4. **Winds in the atmosphere**
   Measuring the wind; the Beaufort scale
   Origin of winds; the atmosphere as a heat engine
   The principal forces acting on an air parcel
   Cyclones and anticyclones
   Thermal gradients and winds
   Global convection and global wind patterns

5. **The ground**
   Soils and soil types
   Water flow through soils and rocks
   Soil temperatures

6. **Energy and the environment**
   Energy demands and energy resources
   Environmental problems of energy production
   Nuclear power
   Renewable energy sources; hydro-electric, wave and wind power, biomass, solar
   Energy conservation; design of buildings

7. **Atmospheric pollution; acid rain**
   Systems approaches to environmental issues
   Acid rain as a regional problem

8. **Sound and noise**
   Definition of the decibel and A-weighted sound levels
   Measures of noise levels; effect of noise levels on hearing
   Domestic noise; design of partitions

Environmental Physics essay

As a core part of the course you are required to write a major essay on a topic relevant to the course. This essay will be marked and is assessed as 10% of the course mark. Should you **not hand in** an essay, you will be **marked as incomplete** and no marks will be credited to you for this course whatever your examination mark. The essay should be about 3500 words and should be illustrated with diagrams, charts etc. It should also give at least three key references showing the sources of your material. The level and style should be (approximately) that of *New Scientist*.

You may choose any topic related to the environment and environmental issues. A title and abstract (about 50 words) providing a brief guide to the proposed content should be handed in by **Thursday 30th January** The complete essay should be handed in by **Thursday 27th March,**

Books for the course

Basic book for the course

1. *Introduction to Environmental Physics: Planet Earth, Life and Climate* by Nigel Mason and Peter Hughes; Taylor and Francis 2001

The books below are also useful for parts of the course, although McIlveen's is at a significantly higher level than is required for this course

1. *Fundamentals of Weather and Climate* (2nd Edition) by Robin McIlveen; Chapman and Hall, 1992
2. *Energy, Resources and Environment* eds, John Blunden and Alan Reddish, Hodder and Stoughton 1996

There is a very short section in Mason and Hughes on noise. The best extended discussion (which is not at too high a level) is Chapter 12 (Environmental Acoustics) of

Fundamentals of Acoustics (*3rd Edition*), by L.E. Kinsler, A.R. Frey, A.B. Coppens and J.V. Sanders; Wiley