

FALL 2019 PHY570  
ENVIRONMENTAL PHYSICS  
COMPUTATIONAL PROJECTS

MIRON KAUFMAN

DEPARTMENT OF PHYSICS  
CLEVELAND STATE  
UNIVERSITY  
CLEVELAND OH.44115

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**COURSE: ENVIRONMENTAL PHYSICS, PHY570, 4 credit hours**

**INSTRUCTOR:** MIRON KAUFMAN

**OFFICE:** SI-116, TEL.216-6872436

**EMAIL:** m.kaufman@csuohio.edu

**COURSE WEB PAGE**

<http://www.csuohio.edu/sciences/dept/physics/physicsweb/kaufman/physenv.html>

**Class Meeting Times and Location:**

LECTURE: M, W 4:00 - 5:50 PM, BH-430

OFFICE HOUR: M, W 3:00 - 3:50 PM, SI-116

**REQUIRED MATERIALS:**

McFarland, Hunt, Campbell, *Energy, Physics and the Environment.*

Kaufman *Environmental Physics Computational Projects;*

CD/memory stick.

**COURSE GOALS:**

The main goal of the course is to foster rational thinking in complex decision situations related to environmental problems by studying the physical laws underlying environmental phenomena. This course provides a middle ground, for science and engineering students on one hand and urban studies, law and education students on the other hand, to discuss, learn cooperatively and achieve a scientific understanding of important environmental issues such as: the global warming, urban heat island, heat pollution, radiation and health and conventional versus nuclear energy. Computer modeling is used to enhance the understanding of the issues through visualizations. The diffusion of pollutants in the atmosphere and radioactive decay are taught through Monte Carlo simulations. The computer modeling part of the course is performed using the industry standard MathCAD. Further simulations are performed on models of consumption such as the exponential and the Hubbert models. The course incorporates four modules: Thermodynamics, Electromagnetism, Nuclear Physics, and Environmental Modeling. In each module after learning the basic physics the students study the environmental implications. For example during the Thermodynamics module we analyze heat pollution and the urban heat island effect. The Greenhouse effect is studied during the Electromagnetism module. The students are exposed to chaos theory by analyzing the period doubling route to chaos prevalent in population models. We emphasize the main characteristic of deterministic chaos: the butterfly effect, i. e. sensitivity to initial conditions.

**TENTATIVE SCHEDULE:**

WEEK #1	Energy, Power	Ch.1
WEEK #2, 3	Consumption Models: Exponential, Hubbert	Ch.2, 3
WEEK #4	Thermodynamics: Energy and Entropy Laws	Ch.4
WEEK #5	Heat Transfer	Ch.16
WEEK #6	Fossil Fuel Effect on the Environment: Heat and Air Pollution, Urban Heat Island	Ch.5
WEEK #7	Electricity	Ch.7
WEEK #8	Magnetism	Ch.8
WEEK #9, 10	Black-Body Radiation, Global Climate Change	Ch.6
WEEK #11	Power Lines and Health	Ch.9
WEEK #12, 13	Radioactivity	Ch.10
WEEK #14, 15	Nuclear Energy	Ch.10
WEEK #15	Environmental Modeling: Chaos Theory, Population Dynamics	

**PREREQUISITES:** PHY221 or PHY231 or PHY241 or PHY243 or PHY243H

**IMPORTANT DATES:**

**NO CLASSES:** MONDAY SEPTEMBER 2.

**LAST DAY TO WITHDRAW:** FRIDAY NOVEMBER 1.

**EXAM #1** Ch.1, 2, 3, 4, 5, 16 MONDAY, OCTOBER 14

**FINAL EXAM** COMPREHENSIVE MONDAY, DECEMBER 9

**GRADING:**

The final grade is the weighted average of:

- |                      |     |
|----------------------|-----|
| ➤ Exam #1            | 30% |
| ➤ Final Exam         | 35% |
| ➤ Computational Work | 25% |
| ➤ Homework, Quizzes  | 10% |

There will be 10 homework assignments and 2 quizzes. The homework assignments, quizzes and exams are **not** multiple-choice and are graded by hand.

Grading Scale: A 91 - 100; A- 86-90; B+ 81 - 85; B 76 - 80; B- 71 - 75;

C 56 - 70; F 0 - 55.

**OTHER INFORMATION:**

- Educational access is the provision of classroom accommodations, auxiliary aids and services to ensure equal educational opportunities for all students regardless of their disability. Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Office of Disability Services at (216) 687-2015. The Office is located in MC 147. Accommodations need to be requested in advance and will not be granted retroactively.
- There will be ten homework assignments and two quizzes. The homework assignments, quizzes and exams are not multiple-choice and are graded by hand. Derivations of the results have to be presented. No electronic devices with internet access are allowed during exams and quizzes.
- All exams must be taken. Otherwise the final grade will be F regardless of the numerical grades.
- Attending the lectures is essential for the proper understanding of the material. The students are responsible for all the material discussed in class. Attendance requirements are stated in the CSU Graduate Bulletin.
- Part of the course is computational work. On Wednesday September 4, Wednesday September 18, Wednesday October 2, Wednesday October 16, Wednesday October 30, Wednesday November 6, Wednesday November 13, Wednesday November 20 we will meet from 4PM to 5:50PM in the Physics Department Computer Lab in SI-150. Attendance of the computer sessions is **obligatory** and **is included in the grading** of the computational work. We will do modeling projects on Environmental Physics by using the software MathCAD. You should save your work on a memory stick. At the end of the semester, on Wednesday December 4, each student will give me the memory stick with all the programs and a printout of the results.

## ENVIRONMENTAL PHYSICS PHY570 CALENDAR

	<b>Monday 4:00-5:50PM BH-430 or SI-150</b>	<b>Wednesday 4:00-5:50PM BH-430 or SI-150</b>
<b>Week 1</b>		
<b>Week 2</b>	<b>Sept. 2, no class</b>	<b>Sept.4, Comp. Lab. 1</b>
<b>Week 3</b>		
<b>Week 4</b>		<b>Sept.18, Comp. Lab. 2</b>
<b>Week 5</b>		
<b>Week 6</b>		<b>Oct.2, Comp. Lab. 3</b>
<b>Week 7</b>		
<b>Week 8</b>	<b>Oct. 14, Exam I</b>	<b>Oct.16, Comp. Lab. 7</b>
<b>Week 9</b>		
<b>Week 10</b>		<b>Oct.30, Comp. Lab. 4</b>
<b>Week 11</b>		<b>Nov.6, Comp. Lab. 5</b>
<b>Week 12</b>		<b>Nov.13, Comp. Lab. 6</b>
<b>Week 13</b>		<b>Nov.20, Comp. Lab. 8</b>
<b>Week 14</b>		
<b>Week 15</b>		<b>Dec.4, Comp. proj. due</b>
<b>Week 16</b>	<b>Dec.9, 4:00-6:00PM, Exam II</b>	



**ASSIGNMENTS**

**HOMEWORK #1**

McFarland, Hunt, Campbell Ch.1

Exercises: 1, 2, 3, 4, 5, 6, 7.

Problems: 8, 11.

DUE: W 9-4-19

**HOMEWORK #2**

McFarland, Hunt, Campbell Ch.2

Exercises: 1, 2, 3;

Problems: 6, 7, 8.

DUE:

**HOMEWORK #3**

McFarland, Hunt, Campbell Ch.4

Exercises: 2, 3, 4, 5, 6;

Problems: 8, 9, 10, 11, 13, 17.

DUE:

**HOMEWORK #4**

McFarland, Hunt, Campbell Ch.16

Exercises: 2;

Problems: 7, 8, 9.

DUE:

**HOMEWORK #5**

McFarland, Hunt, Campbell Ch.5

Exercises: 1, 2, 7, 8;

Problems: 9, 10, 11, 12, 13, 14, 15, 16.

DUE:

**HOMEWORK #6**

McFarland, Hunt, Campbell Ch.7

Exercises: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12;

Problems: 13, 14, 15, 16, 17, 18, 19, 20, 21.

DUE:

**HOMEWORK #7**

McFarland, Hunt, Campbell Ch.8

Exercises: 1, 3, 5, 6, 7, 8, 9;

Problems: 10, 11, 12, 13, 14, 15.

DUE:

**HOMEWORK #8**

McFarland, Hunt, Campbell Ch.6

Exercises: 1, 2, 3, 4, 5;

Problems: 6, 7, 8, 9, 10, 11, 12, 14, 16.

DUE:

**HOMEWORK #9**

McFarland, Hunt, Campbell Ch.10

Exercises: 1, 2, 3, 4, 5, 6, 7;

Problems: 8, 9, 10, 11, 12, 15.

DUE:

**HOMEWORK #10**

McFarland, Hunt, Campbell Ch.10

Problems: 17, 18, 19, 20, 21, 22, 23.

McFarland, Hunt, Campbell Ch.11

1, 2, 3, 5.

DUE: