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# **Numeric Class Schedules**

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**numeric**

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# UNDERGRADUATE NUMERICAL TECHNIQUES FOR ATMOSPHERE, OCEAN AND EARTH SCIENTISTS: ATSC 409

## 1.1 PDF copy

Grad and Ugrad syllabi and schedule

## 1.2 Calendar Entry

Web-based introduction to the practical numerical solution of ordinary and partial differential equations including considerations of stability and accuracy. Credit will not be granted for both ATSC 409 and ATSC 506/EOSC 511.

## 1.3 Course Purpose

The students completing this course will be able to apply standard numerical solution techniques to the solution of problems such as waves, advection, population growth.

## 1.4 Instructors

Phil Austin, 2-2175, [paustin@eos.ubc.ca](mailto:paustin@eos.ubc.ca), Rm 157 EOS South  
Susan Allen, 2-2828, [sallen@eos.ubc.ca](mailto:sallen@eos.ubc.ca), Rm 3017 ESB

## 1.5 Prerequisites

Solution of Ordinary Differential Equations (MATH 215 or equivalent) AND a programming course. Partial Differential Equations (Math 316 or Phys 312) is recommended.<sup>1</sup>

## 1.6 Course Structure

This course is not lecture based. The course is an interactive, computer based laboratory course. The computer will lead you through the laboratory (like a set of lab notes) and you will answer problems most of which use the computer.

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<sup>1</sup> If you have PDE's Lab 7 is strongly recommended, whereas if you do not have PDE's do Lab 6

The course consists of three parts. A set of interactive, computer based laboratory exercises, two mini-projects and a final project.

During the meeting times, we will hold short quizzes (just to make sure you are keeping up) and brief presentations to help with technical matters and the more difficult sections of the course.

You can use a web-browser to examine the course exercises. Point your browser to:

<http://clouds.eos.ubc.ca/~phil/numeric>

## 1.7 Grades

- Laboratory Exercises 30%
- Quizzes 10%
- Mini-projects 20%
- Project Proposal 5%
- Project 30%
- Project Oral Presentation 5%

## 1.8 Meeting Times

1400-1600 Thursdays, Room 203, Earth and Oceans Sciences (EOS) Main

## 1.9 Laboratory Problem Sets

The laboratory problem sets can be given to either instructor when completed. (We have mail boxes in the Earth and Ocean Sciences Main Office). They may be hand written or typed. You may wish or be asked to include plots and diagrams. You can email us plots instead of printing them. Sometimes, rather than a large series of plots, you may wish to include a summarizing table. If you do not understand the scope of a problem, please ask. The time scales given in the Contents section are based on 7 hours/week additional to class time. Help with the labs is available 1) through a mailing list so you can contact your classmates and ask them 2) during the weekly scheduled lab or 3) directly from the instructors. Assignments, mini-projects and the project are expected on time. Late ones will be marked and then the mark will be multiplied by  $(0.9)^{(\text{number of days or part days late})}$ . (Below we give two dates for each assignment. You should aim for the first one (this would keep you totally up to date). The later one allows a couple of days in case.)

## 1.10 Contents

Each laboratory is separated into sessions of about 2 hours. You may do the sessions any time during the week. You will need to complete three sessions a week to keep up with the course material covered in the quizzes.

- Introductory Meeting
- Laboratory One
  - Four sessions: 1) section 3, 2) section 4, 3) section 5, 4) section 6.

- Quiz #1 Objectives<sup>2</sup> pertaining to Lab 1 sections 3-5
- Quiz #2 Objectives pertaining to Lab 1 and Lab 2 sections 3-4.
- Assignment: See web.
- Laboratory Two
  - Three sessions: 1) section 3-4.1.1, 2) section 4.1.2-end 4, 3) sections 5-7
  - Quiz #2 Objectives pertaining to Lab 1 and Lab 2 sections 3-4.
  - Quiz #3 Objectives pertaining to Lab 2 and Lab 3 section 2.
  - Assignment: See web.
- Laboratory Three
  - Four sessions: 1) section 2- begin 2.4.1, 2) section 2.4.1-end 2, 3) section 3-4, 4) section 5
  - Quiz #3 Objectives pertaining to Lab 2 and Lab 3 section 2.
  - Quiz #4 Objectives pertaining to Lab 3.
  - Assignment: See web.
- Mini-Project #1
  - Two sessions
  - Details on web.
- Laboratory Four
  - Four sessions: 1) section 3, 2) section 4.1-4.2, 3) section 4.3-5, 4) finish problem set
  - Quiz #5 Objectives pertaining to Lab 4 sections 3-4.2
  - Quiz #6 Objectives pertaining to Lab 4 and Lab 5 section 3
  - Assignment: See web.
- Laboratory Five
  - Three sessions: 1) section 3, 2) section 4, 3) section 5
  - Quiz #6 Objectives pertaining to Lab 4 and Lab 5 section 3
  - Quiz #7 Objectives pertaining to Lab 5
  - Assignment: 4a, 4b, 6-1, 6-2, 6-3
- Mini-Project #2
  - Two sessions
  - Details on web.
- Laboratory Seven (do 7 if you have PDE's)
  - Four sessions: 1) section 3-4.3, 2) section 4.4-4.5, 3) section 5, 4) section 6
  - Quiz #8 Objectives pertaining to Lab 7 section 3-4.3
  - Assignment: See web.
- Laboratory Six (do 6 if you do not have PDE's)
  - Four sessions: 1) section 3 2) section 4-4.2 3) section 4.3-4.4, 4) section 5-6

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<sup>2</sup> Objectives is an older term for Learning Goals

- Quiz #8 Objections pertaining to Lab 6 section 3
- Assignment: See web.
- Project
  - Eight Sessions
  - 20 minute presentation to the class
  - Project report



## GRADUATE NUMERICAL TECHNIQUES FOR ATMOSPHERE, OCEAN AND EARTH SCIENTISTS: EOSC 511 / ATSC 506

### 2.1 PDF copy

Grad and Ugrad syllabi and schedule

### 2.2 Course Purpose

The students completing this course will be able to apply standard numerical solution techniques to problems in Oceanographic, Atmospheric and Earth Science.

### 2.3 Instructors

Phil Austin, 2-2175, [paustin@eos.ubc.ca](mailto:paustin@eos.ubc.ca), Rm 157 EOS South  
Susan Allen, 2-2828, [sallen@eos.ubc.ca](mailto:sallen@eos.ubc.ca), Rm 3017 ESB

### 2.4 Prerequisites

The course assumes a mathematics background including vector calculus and linear algebra. Students weak in either of these areas will be directed to readings to strengthen their knowledge. Some programming experience is greatly recommended.

### 2.5 Course Structure

This course is not lecture based. The course is an interactive, computer based laboratory course. The computer will lead you through the laboratory (like a set of lab notes) and you will answer problems most of which use the computer. The course consists of three parts. A set of required interactive, computer based laboratory exercises, a choice of optional laboratory exercises and a project. The project will be determined through consultation between the student and their supervisor.

During the meeting times, we will have brief presentations to help with technical matters and the more difficult sections of the course. It is highly recommended that you join us to work on the course during the meeting times. Past students who did so got a great deal more out of the course than those that worked on their own.

You can use a web-browser to examine the course exercises. Point your browser to:

<http://clouds.eos.ubc.ca/~phil/numeric>

## 2.6 Meeting Times

1400-1600 Tuesdays, Room 203, Earth and Oceans Sciences (EOS) Main

## 2.7 Grades

- Laboratory Exercises 30%
- Project Proposal 10%
- Project 50%
- Project Oral Presentation 10%

## 2.8 Laboratory Problem Sets

The laboratory problem sets can be given to either instructor when completed. (We have mail boxes in the Earth and Ocean Sciences Main Office). They may be hand written or typed. You may wish or be asked to include plots and diagrams. Sometimes, rather than a large series of plots, you may wish to include a summarizing table. If you do not understand the scope of a problem, please ask. The time scales given in the Contents section are based on 9 hours/week. Help with the labs is available 1) through a mailing list so you can contact your classmates and ask them 2) during the weekly scheduled lab or 3) directly from the instructors. Assignments and the project are expected on time. Late ones will be marked and then the mark will be multiplied by  $(0.9)^{(\text{number of days or part days late})}$ . (Below we give two dates for each assignment. You should aim for the first one (this would keep you totally up to date). The later one allows a couple of days “in case”.)

## 2.9 Set Laboratories

Recommended timing. Problems to be handed in can be found on the webpage.

- Laboratory One: One Week
- Laboratory Two: One Week
- Laboratory Three: One Week
- Laboratory Four: One and a Half Weeks
- Laboratory Five: Half a Week
- Laboratory Seven: One Week

## 2.10 Optional Laboratories

Choose one of the following concentrations or talk to your instructors about a combination of your choosing. Time scale two and a half weeks.

### 2.10.1 ODE's and FFT's

- Rest of Lab 5
- Lab 6
- Lab 9 (FFT's)

### 2.10.2 PDE's

- End of Lab 7
- Lab 8
- Lab 10

## 2.11 Project

- Chosen in consultation with your research supervisor and the instructors. Should be chosen before the optional labs.
- Time scale three and half weeks.



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**CHAPTER  
THREE**

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**DATES**

<b>Date</b>	<b>Class</b>	<b>Quiz</b>	<b>Assignments Grad</b>	<b>Assignments UnderGrad</b>
Sep 7	Installation	none		
	Intro to Notebook			
Sep 14	Python and	Quiz 1	Lab 1	
	Numpy in Notebook			
<i>Sep 15</i>				Lab 1
<i>Sep 18</i>			Lab 1 LNPD	Lab 1 LNPD
Sep 21	VS Code	Quiz 2	Lab 2	
<i>Sep 22</i>			Lab 2 LNPD	Lab 2
<i>Sep 26</i>				Lab 2 LNPD
Sep 28	Functions inside and	Quiz 3	Lab 3	
	outside of Notebooks			
<i>Oct 2</i>			Lab 3 LNPD	Lab 3
Oct 5	Python Debugger	Quiz 4	Lab 4	Lab 3 LNPD
<i>Oct 6</i>				Miniproject 1
<i>Oct 10</i>			Lab 4 LNPD	
<i>Oct 11</i>				MP1 LNPD
Oct 12	Speeding Up Code	Quiz 5	Lab 5	
<i>Oct 16</i>				Lab 4
<i>Oct 17</i>			Lab 5 LNPD	
Oct 19		Quiz 6	Lab 7	Lab 4 LNPD
<i>Oct 23</i>			Lab 7 LNPD	Lab 5
Oct 26		Quiz 7	Project Proposal	Lab 5 LNPD
<i>Oct 27</i>				Miniproject 2
<i>Oct 30</i>			Proj. Prop. LNPD	
<i>Oct 31</i>				MP2 LNPD
Nov 2		Quiz 8	Optional Labs	
<i>Nov 3</i>				Lab 6/7
<i>Nov 7</i>			Opt. Lab LNPD	Project Proposal
				Lab 6/7 LNPD
Nov 9				
<i>Nov 14</i>				Proj. Prop. LNPD
Nov 16				
Nov 23	Presentations 1			
<i>Nov 27</i>			Project Due	Project Due
Nov 30	Presentations 2			
<i>Dec 1</i>			Project LNPD	Project LNPD

LNPD = Last No Penalty Date

Assignments are due at 17:00.