

# SYLLABUS for PHYSICS 4950

Spring 2011

## Directed Study: Differential Equations in Physical Systems

**instructor:** Dr Cecilia Barnbaum *cbarnbau@valdosta.edu*

**meeting time:** T Th 11:00 am to 12:15pm

**final exam** **F 6 May 10:15am**

**office hours** NH 3022 hours MW 11am to 1pm and TR 9:30 am to 11:00 am and 12:30 to 2 pm

**required texts:** ★ *CRC Mathematical Tables*

★ I will provide you with reading material and problem sets. Most will be taken from:  
*Multivariate Calculus, Linear Algebra and Differential Equations* by S. I. Grossman

**suggested text:** Very useful compilation of integrals is found in *Integral Tables* by Gradshteyn and Ryzhik.

**description:** Differential equations are a basic tool of physics. We will study primarily Ordinary Differential Equations (ODEs) with boundary conditions and how to solve them. The emphasis will be on ODEs which are important in physical problems such as occur in mechanics, E&M, quantum mechanics, and optics. If time allows, we will introduce Partial Differential Equations (PDEs).

**requirements:** Junior or Senior level standing and permission of the instructor.

**grading:** Your performance will be judged on the following:

3 midterms @ 20% each	60 %
homework	5 %
final exam	35 %

Your final grade in the course will be based on the total number of points you achieve, weighted as indicated above, such that:

87.5	—	100.0 %	A
75.0	—	87.4 %	B
62.5	—	74.9 %	C
50.0	—	62.4 %	D
0	—	49.0 %	F

At **any time** if you wish to know your current grade, please come see me.

**homework:** Homework will be due once a week and full solution sets will be provided. Only one or two problems will be graded for each homework set, chosen at random. If you do not do the problems consistently, you will not be able to pass the exams. The midterms and the final exam will consist of problems similar but not identical to the homework.

**expectations:** You are expected to attend all course meetings. **Absences in excess of 20% (more than 6 scheduled classes) will result in a failing grade**, as outlined in the *2010–2011 VSU Undergraduate Bulletin*. Be in class on time. It is a disturbance to students and me to be interrupted by late-comers.

Homework will be collected each week. One or two problems will be graded for each homework set, at random. Full solution sets will be distributed when the problem sets are due.

You are expected to do your best!!! And ask questions!!!

**general policies:** No late homework will be accepted.

If you miss an exam (i.e., you are absent without making arrangements with me *beforehand*) you will receive a zero for that midterm exam. My approval for an absence depends on your having a *legitimate* reason. (Note: a doctor's appointment is *not* a legitimate reason to miss an exam).

The **final exam** will be **comprehensive**. *No one will be exempt from taking the final exam for any reason.*

**Cheating is absolutely unacceptable. The first offense will result in a failing grade in this course and prosecution toward being expelled from the University System of Georgia.**

Students requiring accommodation due to a **documented disability** should discuss their needs with the Access Office for Disabled Students ((229) 245-2498), and I will do everything possible to make reasonable accommodations.

Departmental Selected Outcomes: 1, 2, 3

VSU General Education Outcomes: 3, 5, 7

## Schedule of Lectures

<b>Differential Equations in Physical Systems</b>			
Week #	Date	Topics	Reading
1	11 Jan	Introduction to Ordinary Differential Equations; Review of Complex Numbers and Euler's Relation	G. App 3
2	18	Classification of ODEs; First Order Non-Linear ODE: Separation of Variables and Initial Conditions	G: 11.1, 11.2
3	25	First Order Linear ODE: Integrating Factors; and Exact Equations	G: 11.3, 11.4, 11.5
4	1 Feb	<b>FIRST MIDTERM EXAM</b>	
5	8	First Order Linear ODE: Bernoulli's Equation; Introduction to Second Order ODE; The Wronskian; Equation of Motion; Damped Harmonic Oscillator	G: 11.6
6	15	Second Order Linear Homogeneous ODE: For Variable Coefficients: finding $y_2$ given $y_1$ ; For Constant Coefficients with Real and Degenerate Characteristic Equation	G: 11.7, 11.8
7	22	Second Order Linear Homogeneous ODE: Constant Coefficients with Imaginary and Complex Characteristic; Euler's Equation	G: 11.9
8	1 Mar	<b>SECOND MIDTERM EXAM</b>	
9	8	Second Order Linear Non-Homogeneous ODE: Method of Undetermined Coefficients; Driven Harmonic Oscillator	G: 11.10
10	14 – 18	<b>SPRING BREAK</b>	
11	22	Second Order Linear Non-Homogeneous ODE: Method of Variation of Parameters (Method of Lagrange)	G: 11.11
12	29	$n^{\text{th}}$ Order ODE to $n$ $1^{\text{st}}$ Order ODEs: Method of Elimination; Introduction to Eigenvalues and Eigenvectors	G: 12.1, 12.2, 12.4, (12.6)
13	5 Apr	<b>THIRD MIDTERM EXAM</b>	
14	12	Matrix Solutions to Solve Homogeneous ODEs: Fundamental and Principal Matrix Solutions	G: 12.5, 12.9
15	19	Series Solutions to ODEs, LaPlace Transforms	G: 12.10
16	26	Bessel Equations, Legendre Equations, Numerical Methods; Introduction to Partial Differential Equations	A: 8.4 – 8.6 8.7 – 8.9