

# Ordinary and Partial Differential Equations Math 251, Spring 2009

<http://www.math.psu.edu/gyrya/spring2009/math251.htm>

**CATALOG DESCRIPTION:** Ordinary and Partial Differential Equations (4) First- and second-order equations; special functions; Laplace transform solutions; higher order equations; Fourier series; partial differential equations.

**PREREQUISITE:** MATH 141 or MATH 141H

**TEXT:** *Elementary Differential Equations and Boundary Value Problems*, William E. Boyce & Richard C. DiPrima

9th Edition      ISBN: 978-0-470-38334-6

or

8th Edition      ISBN: 978-0-471-43338-5.

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Office hours: Wednesday & Friday, 11am–noon, 3pm–4pm.

**EXAMINATIONS:** There will be two midterm exams and one final exam. Exam I will be held on Thursday 2/26/06.

Exam II will be announced.

Final Exam will be during Final Exam Week as scheduled by the Registrar. Makeup exams will be given only if a University recognized excuse is provided.

**COURSE GRADES:**

Exam I	100 points	Grade	Cut off
Exam II	100 points	A	90%
Homework & Quizzes	150 points	B	80%
Final Exam	150 points	C	70%
Total	500 points	D	60%

**COURSE DESCRIPTION and NUMBER of LECTURES:**

	INTRODUCTION	
1.1	Direction fields	1
1.2	Solutions of Some DE's	.5
1.3	Classification of DE's	.5
	FIRST ORDER DE's	
2.2	Separable Equations	1
2.1	Linear Equations with Variable Coefficients	2
2.3	Modeling with First Order Equations (do mixture, interest and air resistance)	3
2.4	Differences Between Linear and Nonlinear Equations	1
2.5	Autonomous Equations, Population Dynamics (cover stability and concavity)	1
2.6	Exact Equations (omit integrating factors)	1
	SECOND ORDER LINEAR EQUATIONS	
p.131	The case of the missing $y$ and the case of the missing $t$	1
3.1	Homogeneous Equations with Constant Coefficients (cover the equations with missing $y$ or missing $t$ , initial value problems with data specified not at 0)	2
3.2	Fundamental Solutions of Linear Homogeneous Equations	2
3.3	Complex Roots of the Characteristic Equations	2
3.4	Repeated Roots; Reduction of Order	1
3.5	Nonhomogeneous Equations; Method of Undetermined Coefficient	3
3.7	Mechanical Vibrations (omit electrical vibrations)	2
3.8	Forced Vibrations (no damping)	1
	HIGHER ORDER LINEAR EQUATIONS	
4.2	Homogeneous Equations with Constant Coefficients	1
	SERIES SOLUTIONS OF SECOND ORDER LINEAR EQUATIONS	
5.2	Series solutions near an ordinary point	1

	THE LAPLACE TRANSFORM	
6.1	Definition of the Laplace Transform	2
6.2	Solution of Initial Value Problems	2
6.3	Step Functions	1
6.4	Differential Equations with Discontinuous Forcing Functions	1
6.5	Impulse Functions	1
	SYSTEMS OF FIRST ORDER LINEAR EQUATIONS	
7.1	Introduction to Systems of Differential Equations	1
7.5-9	Classification of critical points and sketching phase portraits.	2
	NUMERICAL METHODS	
8.1	The Euler or Tangent Line Method	1
	NONLINEAR DIFFERENTIAL EQUATIONS AND STABILITY	
9.1	Phase portraits and stability	1
9.2	Phase portraits for Nonhomogeneous Linear systems	1
9.5	Linearize a nonlinear system at each of its critical points. Phase portrait for predator-prey equation.	1
	PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES	
10.1	Two Point Boundary Value Problems	1
10.2	Fourier Series	2
10.3	The Fourier Theorem	2
10.4	Even and Odd Functions	2
10.5	Separation of Variables; Heat in a Rod	2
10.6	Other Heat Conduction Problems	2
10.7	The Wave Equation: Vibrations of an Elastic String	1
10.8	Laplace's Equation	1
	Review	3
	Total	59

## ACADEMIC INTEGRITY STATEMENT:

“Academic dishonesty includes, but is not limited to, cheating, plagiarizing, . . . facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students . . . A student charged with academic dishonesty will be given oral or written notice of the charge by the instructor. If students believe that they have been falsely accused, they should seek redress through informal discussions with the instructor, the department head, dean or campus executive officer. If the instructor believes that the infraction is sufficiently serious to warrant the referral of the case to Judicial Affairs, or if the instructor will award a final grade of *F* in the course because of the infraction, the student and instructor will be afforded formal due process procedures.” From *Policies and Rules, Student Guide to the University*, Policy 49–20.

Based on the *University’s Faculty Senate Policy 49-20*, a range of academic sanctions may be taken against a student who engages in academic dishonesty. Please see the *Eberly College Academic Integrity* homepage for additional information and procedures.