ELEMENTARY DIFFERENTIAL EQUATIONS

The University of Toledo

Mathematics & Statistics Department, College of Natural Sciences and Mathematics

MATH2860-0XX, CRN XXXXX

Instructor:	(Insert Name)	**Class Location:**	(Insert Building/Room)
Email:	(Insert Email Address)	**Class Day/Time:**	(Insert Days/Time)
Office Hours:	(Insert Days/Time)	**Credit Hours:**	3
Office Location:	(Insert Building/Office #)		
Office Phone:	(Insert Phone Number)		
Term:	(Insert Semester/Year)		

COURSE DESCRIPTION

An introduction to the analysis and solution of ordinary differential equations with emphasis on the fundamental techniques for solving linear differential equations.

STUDENT LEARNING OUTCOMES

Below is the list of learning objectives. At least 70% of the course time will be devoted to these essential outcomes. These objectives are listed again in the chronological list of topics at the end of this syllabus.

- ***Slope fields***: Understand the relationship between slope fields and solution curves for differential equations. Use a slope field and an initial condition to estimate a solution curve to a differential equation.
- ***Standard equations***: Solve first-order differential equations that are separable, linear or exact.
- ***Other equations***: Solve first-order differential equations by making the appropriate substitutions, including homogeneous and Bernoulli equations.
- ***Applications***: Use linear or non-linear first-order differential equations to solve application problems such as exponential growth and decay, falling objects and solution mixtures.
- ***Homogeneous equations***: Solve higher-order homogeneous linear equations with constant coefficients.
- ***Undetermined Coefficients***: Solve higher-order nonhomogeneous linear equations with constant coefficients by the method of undetermined coefficients.
- ***Variation of parameters***: Solve higher-order nonhomogeneous linear equations by the method of variation of parameters.
- ***Applications***: Use linear second-order differential equations to solve application problems such as spring/mass system motion problems and three component series circuits.
- ***Laplace transform***: Perform operations with Laplace and inverse Laplace transforms to solve higher-order differential equations.

PREREQUISITES

Minimum grade of C- in Math 2850 or Math 2950. Students who enroll in Math 2860 but have not passed either prerequisite may be administratively dropped from the class.

TEXTBOOK: *Elementary Differential Equations*, Tenth Edition, by Boyce and Diprima (ISBN:9780470458327)

UNIVERSITY POLICIES:

POLICY STATEMENT ON NON-DISCRIMINATION ON THE BASIS OF DISABILITY (ADA)

The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

ACADEMIC ACCOMMODATIONS

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office (Rocket Hall 1820; 419.530.4981; studentdisabilitysvs@utoledo.edu) as soon as possible for more information and/or to initiate the process for accessing academic accommodations. For the full policy see: `http://www.utoledo.edu/offices/student-disability-services/sam/index.html`

ACADEMIC POLICIES:

STUDENT PRIVACY

Federal law and university policy prohibits instructors from discussing a student's grades or class performance with anyone outside of university faculty/staff without the student's written and signed consent. This includes parents and spouses. For details, see the "Confidentiality of Student Records (FERPA)" section of the University Policy Page at `http://www.utoledo.edu/policies/academic/undergraduate/index.html`

MISSED CLASS POLICY

If circumstances occurring in accordance with The University of Toledo Missed Class Policy (found at `http://www.utoledo.edu/policies/academic/undergraduate/index.html`) result in a student missing a quiz, test, exam or other graded item, the student must contact the instructor in advance by phone, e-mail or in person, provide official documentation to back up his or her absence, and arrange to make up the missed item as soon as possible.

ACADEMIC DISHONESTY

Any act of academic dishonesty as defined by the University of Toledo policy on academic dishonesty (found at `http://www.utoledo.edu/dl/students/dishonesty.html`) will result in an F in the course or an F on the item in question, subject to the determination of the instructor.

GRADING AND EVALUATION

The syllabus should describe the methods of evaluation whether quizzes, exams, or graded assignments. The usual procedure is to give at least two 1 hour in-class exams and a two hour final exam. If quizzes are not used as a portion of the grade, then three 1 hour exams are recommended. How each evaluation method is to count toward the class grade should be described and a grading scale or description of a grading procedure should be provided. It should be kept in mind when scheduling quizzes and exams that the last day to add/drop the class is the end of the second week of classes and the last day to withdraw from the class is the end of the tenth week. By these dates, students like to have some measure of their progress in the class.

IMPORTANT DATES

The instructor reserves the right to change the content of the course material if he perceives a need due to postponement of class caused by inclement weather, instructor illness, etc., or due to the pace of the course.

MIDTERM EXAM:
FINAL EXAM:

OTHER DATES

The last day to drop this course is:
The last day to withdraw with a grade of "W" from this course is:

STUDENT SUPPORT SERVICES

Free math tutoring on a walk-in basis is available in the Math Learning and Resources Center located in Rm B0200 in the lower level of Carlson Library (phone ext 2176). The Center operates on a walk-in basis. MLRC hours can be found at `http://www.math.utoledo.edu/mlrc/MLRC.pdf`

CLASS SCHEDULE

Syllabus should provide a list of sections to be covered and it is advisable to give a tentative exam schedule. Also, it is a good idea to give a class calendar that lists important dates such as last day to drop, last day to withdraw, and the time of the final. See the list of suggested time needed for each section.

Suggested Schedule for MATH 2860

Chapter	1	**Introduction**	(total 3 hrs)
	1.1	Some Basic Mathematical Models; Direction Fields; **Slope Fields**	1.5
	1.2	Solutions to Some Differential Equations; **Standard equations**	1
	1.3	Classification of Differential Equations	0.5
	1.4	**(Op.)** Historical Remarks	
Chapter	2	**First Order Differential Equations**	(total 9 hrs)
	2.1	Linear Equations; Method of Integrating Factors; **Standard equations**	1.5
	2.2	Separable Equations; **Standard equations**	1.5
		Problems 30, 31, 32 **Other equations**	1
	2.3	Modeling with First Order Equations; **Applications**	2
	2.4	Differences Between Linear and Nonlinear Equations	0.5
		Problems 27, 28, 29 **Other equations**	1
	2.5	**(Op.)** Autonomous Equations and Population Dynamics;	
	2.6	Exact Equations and Integrating Factors; **Standard equations**	1.5
	2.7	**(Op.)** Numerical Approximations: Euler's Method	
	2.8	**(Op.)** The Existence and Uniqueness Theorem	
	2.9	**(Op.)** First Order Difference Equations	
Chapter	3	**Second Order Linear Equations**	(total 11 hrs)
	3.1	Homogeneous Equations with Constant Coefficients; **Homogeneous equations**	1
	3.2	Solutions of Linear Homogeneous Equations; **Homogeneous equations**	2
	3.3	Complex Roots of the Characteristic Equation; **Homogeneous equations**	1
		Problem 34 on Euler Equations	0.5
	3.4	Repeated Roots; Reduction of Order; **Homogeneous equations**	1.5
	3.5	Nonhomogeneous Equations; **Undetermined Coefficients**	2
	3.6	Variation of Parameters; **Variation**	1.5
	3.7	Mechanical and Electrical Vibrations; **Applications**	1.5
	3.8	**(Op.)** Forced Vibrations;	
Chapter	4	**Higher Order Linear Equations**	(total 5 hrs)
	4.1	General Theory of nth Order Linear Equations; **Homogeneous equations**	1
	4.2	Homogeneous Equations with Constant Coefficients; **Homogeneous equations**	1.5
	4.3	The Method of Undetermined Coefficients; **Undetermined Coefficients**	1.5
	4.4	The Method of Variation of Parameters; **Variation**	1
Chapter	5	**Series Solutions of Second Order Linear Equations**	(**Optional**)
	5.1	Review of Power Series	
	5.2	Series Solutions Near an Ordinary Point, Part I	
	5.3	Series Solutions Near an Ordinary Point, Part II	
	5.4	Euler Equations; Regular Singular Points	
	5.5	Series Solutions Near a Regular Singular Point, Part I	
	5.6	Series Solutions Near a Regular Singular Point, Part II	
	5.7	Bessel's Equation	
Chapter	6	**The Laplace Transform**	(total 10 hrs)
	6.1	Definition of the Laplace Transform; **Laplace transform**	1.5
	6.2	Solution of Initial Value Problems; **Laplace transform**	2
	6.3	Step Functions; **Laplace transform**	1.5
	6.4	Differential Equations with Discontinuous Forcing Functions; **Laplace transform**	2
	6.5	Impulse Functions; **Laplace transform**	2
	6.6	The Convolution Integral; **Laplace transform**	1
Chapter	7	**Systems of First Order Linear Equations**	(**Optional**)
		Total Hours	38