湖北工業大學
HUBEI UNIVERSITY OF TECHNOLOGY

Course Title	Differential Equations
Course Code	MATH 2311
Semester	Summer 2026
Course Length	4 Weeks, 60 Contact Hours
Credits	4
Instructor	TBA
Office	TBA
Email	TBA
Prerequisite	MATH 1112 Calculus II

Course Description:

This course is an introduction to ordinary differential equations. Topics include first-order and higher order differential equations, series solutions, Laplace transforms, systems of linear equations, and numerical methods for solving ordinary differential equations. Applications to physics, engineering, or other field of science will be emphasized.

Course Goals:

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical thinking skills** – Students will engage in creative and/or innovative thinking, and/or inquiry, analysis, evaluation, synthesis of information, organizing concepts, and constructing solutions.
- **Communication skills** – Students will demonstrate effective written, oral, and visual communication.
- **Teamwork** – Students will demonstrate the ability to work effectively with others to support a shared purpose or goal and consider different points of view.
- **Social responsibility** – Students will demonstrate intercultural competency and civic knowledge by engaging effectively in local, regional, national, and global communities.

Student Learning Outcomes:

Upon completion of this course, students will be able to:

- use qualitative and numerical methods to analyze a family of solutions to a first-order differential equation, particularly an autonomous equation;

- use Laplace transforms to solve first- and second-order initial value problems when the differential equation may be forced by a continuous or discontinuous function;
- solve first-order separable and linear differential equations and corresponding initial value problems;
- Solve differential equations numerically, using Euler's method, the modified Euler's method, and Runge-Kutta methods;
- Understand the theory of differential equations and differential operators, including existence and uniqueness results.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:
Differential Equations: From Calculus to Dynamical Systems, Virginia W. Noonburg, MAA Press.

Course Requirements:

Quizzes & Participation (15%)
- Quizzes (10%): Short, unannounced quizzes (10-15 minutes) will ensure ongoing comprehension of recent material. Topics may include classifying ODEs, sketching phase portraits, or interpreting solutions.
- Participation (5%): Active engagement in discussions, group problem-solving, and peer feedback during workshops. Attendance is mandatory for participation credit; exceptions require documentation.

Homework (25%)
Regular problem sets will reinforce theoretical concepts and problem-solving techniques. These assignments will include analytical solutions and modeling exercises. Homework is designed to encourage consistent engagement with the material and provide feedback before exams.

Midterm Exam (20%)
The midterm will assess mastery of core topics. The exam covers first-order and linear second-order ODEs. The exam will include a mix of computational problems, theoretical questions, and applied modeling.

Final Exam (30%)
The final exam is comprehensive and will test cumulative knowledge of all course content. It will challenge students to synthesize different methods and apply them in multi-step problems, including both theoretical and application-based questions.

Project/Application Report (10%)
Students will complete a small project or report focusing on the application of differential equations to a real-world problem. This assessment encourages deeper exploration of how mathematical modeling is used in fields such as physics, biology, engineering, or economics. Students will select a topic of interest (with instructor approval), research the mathematical model involved, and present both the formulation of the model and the solution process. The report will be evaluated based on mathematical accuracy, clarity of explanation, and relevance of application.

Assessments: Activity	Percent Contribution
Quizzes & Participation	15%
Homework	25%
Midterm Exam	20%
Final Exam	30%
Project/Application Report	10%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Grade	Percentage of available points
A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D	64-69
D-	60-63
F	0-59

Course Schedule:
The schedule of activities is subject to change at the reasonable discretion of the instructor. Minor changes will be announced in class, major ones provided in writing.

MATH 2311 Schedule

Lecture	Topic	Readings
L1	**Introduction to Differential Equations**	Ch. 1
	Modeling with ODEs	
	Basic Terminology	
L2	Families of Solutions & Initial Value Problems (IVP)	Ch. 1
L3	**First-order Differential Equations**	Ch. 2
	Separable First-order Equations	
L4	Linear First-order Differential Equations	Ch. 2
L5	Existence and Uniqueness of Solutions	Ch. 2
L6	More Analytic Methods for Nonlinear First-order Equations	Ch. 2
	Exact Differential Equations	HW1 Due
	Bernoulli Equations	
L7	Numerical Methods	Ch. 2
	Euler's Method	
L8	Improved Euler Method	Ch. 2
	Fourth-order Runge-Kutta Method	
L9	Autonomous Equations, the Phase Line	Ch. 2
	Stability	
L10	**Second-order Differential Equations**	Ch. 3
	Homogeneous Linear Equations with Constant Coefficients	HW2 Due
L11	Nonhomogeneous Linear Equations	Ch. 3
	Method of Undetermined Coefficients	

L12	Variation of Parameters	Ch. 3
L13	Power Series Solutions	Ch. 3
	Linear equations and power series	
L14	Ordinary points and singular points	handouts
L15	Solutions near an ordinary point	handouts
/	**Midterm Exam**	/
L16	**The Laplace Transform**	Ch. 6
	Definition and Some Simple Laplace Transforms	HW3 Due
L17	The Inverse Laplace Transform	Ch. 6
L18	The Unit Step Function	Ch. 6
L19	Convolution and the Impulse Function	Ch. 6
L20	**Linear Systems of First-order Differential Equations**	Ch. 4
	Intro to Systems	HW4 Due
L21	Matrix Algebra	Ch. 4
L22	Eigenvalues and Eigenvectors	Ch. 4
L23	Analytic Solutions to Linear Systems	Ch. 4
L24	**Geometry of Autonomous Systems**	Ch. 5
	The Phase Plane for Autonomous Systems	HW5 Due
	Linear Autonomous Systems	
L25	Nonlinear Autonomous Systems	Ch. 5
	*Project Report Submission	
/	**Final Exam**	/

Accommodation Statement:

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:

Attendance and Expectations

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a

meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

Assignment Due Dates
All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

Make-Up Work
The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for requesting any missed information from the instructor and setting up any necessary appointments outside of class.

Access, Special Needs and Disabilities
Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.