湖北工業大學
HUBEI UNIVERSITY OF TECHNOLOGY

Course Title	Mathematics with Applications to Economics and Business
Course Code	MATH 2142
Semester	Winter 2027
Course Length	4 Weeks, 60 Contact Hours
Credits	4
Instructor	TBA
Office	TBA
Email	TBA
Prerequisite	MATH 1111 Calculus I MATH 1112 Calculus II

Course Description:

This course introduces mathematical methods used in economic analysis, building on prior knowledge of calculus and introductory economic theory. It provides a comprehensive foundation in applied multivariable calculus, linear algebra, and differential equations, with a focus on applications in economics. Through this course, students will deepen their understanding of constrained optimization, comparative statics, and economic dynamics. While tailored to the needs of students in economics, the course prioritizes mathematical rigor and theoretical understanding.

Delivery Mode: This is a fully synchronous online course. Students are expected to attend and participate in real-time lectures and discussions, breakout activities, and problem-solving sessions.

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:

- Analyze systems of linear equations using matrix methods;
- Understand the geometric and algebraic interpretation of vectors and matrices;
- Apply multivariable calculus tools to unconstrained and constrained optimization problems;
- Use Lagrange multipliers to solve optimization models;
- Interpret the economic meaning of gradients and marginal changes;
- Understand and solve basic ordinary differential equations and apply them in economic dynamics.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:

- *Mathematics for Economics* Michael Hoy et al., 3rd Ed. The MIT Press.
- *Calculus for Business, Economics, and the Social and Life Sciences* Hoffmann & Bradley, 11th Ed. McGraw Hill.

Course Requirements:

Homework Assignments

Students will complete six homework assignments throughout the semester, each carefully designed to reinforce and expand upon the mathematical concepts covered in lectures. These problem sets will blend computational exercises with applied economic modeling, requiring students to demonstrate proficiency in techniques ranging from matrix operations and partial derivatives to optimization and integration. The assignments will progressively increase in complexity, culminating in problems that integrate multiple concepts, such as using Lagrange multipliers to solve constrained utility maximization problems.

Quizzes

Three in-class quizzes will be administered at strategic points during the semester to evaluate students' grasp of recently covered material. The quiz format includes a mix of short-answer questions that require mathematical derivation, multiple-choice items testing theoretical knowledge, and applied problems drawn from economic contexts.

Midterm Exam

The midterm exam represents the first major evaluation point in the course, comprehensively assessing material from the first half of the semester. This is an online proctored exam administered through Chaoxing (超星) Smart Examination System using dual-camera proctoring. It will evaluate students' mastery of linear algebra fundamentals, including matrix operations and systems of equations, as well as their ability to work with multivariate calculus concepts such as partial derivatives, gradients, and unconstrained optimization. The exam is carefully balanced between multiple-choice questions that test broad conceptual understanding and free-response problems that require detailed, step-by-step solutions to more complex mathematical economics problems.

Final Exam

As the culminating assessment of the course, the final examination tests students' ability to integrate and apply all course concepts to sophisticated economic problems. Like the midterm, the final exam is proctored synchronously online. The exam emphasizes the application of constrained optimization techniques, as well as the use of integration methods in economic contexts. Differential equations and stability analysis, particularly as applied to dynamic economic models, form another key component of the evaluation.

Assessments: Activity	**Percent Contribution**
Homework Assignments (6)	30%
Quizzes	15%
Midterm Exam	25%
Final Exam	30%

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 2142 Schedule		
Lecture	Topic	Readings
L1	Course Introduction Review of Basic Calculus with its Economic Applications Univariate Calculus and Optimization	Notes
L2	Systems of Linear Equations Gaussian Elimination	*Michael* Ch. 7
L3	Matrices Basic Matrix Operations	*Michael* Ch. 8
L4	Matrix Transportation Some Special Matrices	*Michael* Ch. 8
L5	Determinants and the Inverse Matrix Defining the Inverse	*Michael* Ch. 9
L6	Cramer's Rule HW #1	*Michael* Ch. 9
L7	Review of Linear Algebra and Economic Applications	Review Material

L8	Functions of Several Variables and Continuity	*Hoffmann* Ch. 7
L9	Partial Derivatives, Gradients, and Total Derivatives	*Michael* Ch. 11
	HW #2	*Hoffmann* Ch. 7
L10	Directional Derivatives and the Chain Rule	*Hoffmann* Ch. 2
L11	Marginal Analysis	*Hoffmann* Ch. 2
	Implicit Differentiation	
L12	Unconstrained Optimization: First- and Second-Order Conditions	*Michael* Ch. 13
	HW #3	
L13	Constrained Optimization via Substitution	*Michael* Ch. 13
/	**Midterm Exam**	/
L14	Lagrange Multipliers and Applications	*Michael* Ch. 13
L15	Interpretation of Multipliers and Comparative Statics	*Michael* Ch. 13-14
	HW #4	
L16	Introduction to Integration and Economic Applications	*Hoffmann* Ch. 5
L17	Integration and Dynamic Methods	*Michael* Ch. 17
	An Introduction to Mathematics for Economic Dynamics	
L18	Integration: Antiderivatives	*Hoffmann* Ch. 5
	Integration by Substitution	
L19	Definite Integrals	*Hoffmann* Ch. 5
	HW #5	
L20	Double Integrals	*Hoffmann* Ch. 7
L21	Additional Topics in Integration	*Hoffmann* Ch. 6
	Integration by Parts; Integral Tables	
L22	Introduction to Differential Equations	*Hoffmann* Ch. 6
L23	Improper Integrals; Continuous Probability	*Hoffmann* Ch. 6
	HW #6	*Michael* Ch. 16
L24	First-Order Differential Equations and Dynamic Models	*Michael* Ch. 18
L25	Second-Order ODEs; Stability and Phase Diagrams	*Michael* Ch. 20
/	**Final Exam**	/

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.