

COURSE NAME: Application of Mathematics to Agricultural Economics

COURSE NUMBER: 11:373:211

SEMESTER: Fall 2019

MEETING DAYS, TIMES, AND PLACE: M, TH 10:55AM – 12:15PM, HCK 205

PREREQUISITE: 01:640:112 or 01:640:115

CONTACT INFORMATION:

Instructor(s): Isaac Vellangany, PhD, MBA

Office Location: Cook Office Building, room 112

Phone: 848-932-9131 Email: isaacv@sebs.rutgers.edu

Office Hours: M, TH 2:20PM – 4:30PM

COURSE WEBSITE, RESOURCES AND MATERIALS:

N/A

COURSE DESCRIPTION:

This course provides an introduction to the mathematical techniques used in contemporary economics, including multivariable calculus, comparative statics, and unconstrained and constrained optimization. Emphasis will be placed on applications of microeconomic and macroeconomic theory, and the interpretation and translation of mathematical results into economic terms.

LEARNING GOALS:

1. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, and words).
2. Use exponential and logarithmic functions to analyze growth, interest compounding and investment appraisal.
3. Demonstrate understanding of and ability to explain the economic applications of differentiation, and use it to formulate economic problems, including marginal utilities, elasticity, marginal cost/ benefit, marginal product of labor/capital.
4. Derive constrained optima using the Lagrange multiplier and substitution methods.
5. Understand and use these techniques to solve problems in economics, such as profit maximization, cost minimization or utility optimization.
6. Utilize matrix algebra to find the unknowns: Cramer's rule, Inverse Methods and Gauss-Markov elimination procedure: use graphic calculator.
7. Apply linear programming principles and applications to solve real world problems: use solver in excel spreadsheet.

COURSE OBJECTIVES:

1. Enable students the basic facts of calculus of functions of several variables, including calculation of partial derivatives of explicit and implicit functions, solutions of problems of unconditional and conditional optimization.

2. The student should be able to investigate economic problems of comparative statics using the methods of a calculus, to discover points of maximum and minimum for functions of several variables, to use the method of Lagrange multiplier, to find extreme points of functions subjected to constraints.
3. The student should have skills of application of the indicated mathematical tools and methods to solution of problems in Micro- and Macroeconomics.

ASSIGNMENTS/RESPONSIBILITIES, GRADING & ASSESSMENT:

Complete all the homework assignment and quizzes as specified below. Attendance is mandatory for this class, except unavoidable circumstances. The grade weights of these requirements are the given in the table below. all homework assignments are to be turn in within the deadline. Any homework submitted after the due date will not be accepted. If you miss a quiz, you will receive a grade of zero for that quiz. Attendance is mandatory for this course.

Grade Components	Possible points	Percentage weight
Homework 1	100	5
Homework 2	100	5
Homework 3	100	5
Homework 4	100	5
Quiz 1	100	10
Quiz 2	100	10
Quiz 3	100	10
Quiz 4	100	10
Attendance, participation	100	10
Cumulative Final test*	100	30
Total	1000	100
Grading Scale:		
A = 90 % and above	B+ = 85%-89%	B = 80%-84%
C+ = 75%-79%	C = 70%-74%	D= 61%-69%
F = 60%and below		

*to assess students learning goal outcome

Attendance: You are required to attend classes regularly. All homework assignment will be given in the class. You are responsible to get the assignment from others if you are absent on that day. Use university absent reporting system if you are unable to attend the class. Do not email the reasons for your absence. A student may be absent without penalty for 10% of the number of scheduled class meetings during the semester as follows:

Allowable Absence if class meets: 1 time/week -2 classes, 2 times/week - 3 classes, 3 times/week - 4 classes. For this class, if you miss more than 3 classes, you are likely to lose 5% of the grade.

My Accommodations: Within the My Accommodations section of Rutgers University website, you will find details on how to manage your [reasonable accommodations](#). If you have not already gone through the approval process, please go to the [Applying for Services](#) section of our site.

Academic Integrity: Standards of academic conduct are set forth in the University's Academic Integrity Code. By registering, you have acknowledged your awareness of the Academic Integrity Code, and you are obliged to become familiar with your rights and responsibilities as defined by the Code. Please see me if you have any questions about the academic violations described in the Code, which is available online at: [Policy on Academic Integrity -- Rutgers](#)

Email: Please do not enquire your grade via email. It is the university policy that under no circumstances instructors are permitted to transmit grade via email. All your midterm grades will be made available in the class and on Sakai and the final course grade will be posted on the Rutgers web site within 48 hours after the final exam. I will respond to your weekend email on the first working day after that weekend.

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

COURSE SCHEDULE:

Tentative schedule: (I reserve the right to alter the schedule as and when necessary during the course of the semester).

- I. Introductory Mathematical Concepts
 - a. Notation
 - b. Variables, Constants & Parameters
 - c. Number Systems
 - d. Set Algebra
 - e. Necessary & Sufficient Conditions

Application: General application to economics and business: Consumer behavior, producer's behavior, sellers' behavior and the tax implications on individual and social well-being. What is a tangent and the shape of the curve at the tangent and its implications for maximization and minimization problems?

- II. Functions
 - a. Monotonicity
 - b. Inverse
 - c. Composite
 - d. Extreme Values
 - e. Secant Lines & Average Rate of Change
 - f. Concavity & Convexity
 - i. Frequently Used Functions (1. Polynomials, 2. Exponentials, 3. Logs)

Applications to growth: Indifference curve, demand curve, supply and isoquants. Exponential function applied to models of exponential growth and decay and Solow growth model.

- III. Equilibrium Analysis
 - a. Solving Systems of Equations
 - i. Repeated Substitution
 - ii. Adding and Subtracting Equations
 - iii. Gaussian Elimination
 - b. Comparative Statics.

Application: Demand and supply and the market clearing quantity and price, price ceiling and price floor.

- IV. Matrix Algebra
 - a. Definitions
 - b. Basic Operations
 - c. Determinants
 - d. Linear Dependence and Singularity
 - e. Inverting a Matrix
 - f. Cramer's Rule

Application: Multi-production facilities and the optimal output from each facility that maximizes corporate profit.

- V. Univariate Differential Calculus
 - a. Difference Quotient
 - b. Differentiability & the Derivative
 - c. Differentials
 - d. Rules for Differentiation
 - e. Higher-order Derivatives

Application: Marginal analysis: Utility function, cost function and profit function and Cobb-Douglas production function.

- VI. Multivariate Differential Calculus
 - a. Partial Derivatives and the Gradient
 - b. Higher-Order Partial Derivatives
 - c. Cross Partial Derivatives, Young's Theorem & the Hessian
 - d. Multivariate Chain Rule
 - e. Homogeneity
 - f. Euler's Theorem
 - g. Implicit Function Theorem.

Application: Economic interpretation, price elasticity of demand, price elasticity of supply, income elasticity of demand, marginal products, elasticity and total revenue.

- VII. Unconstrained Optimization of Univariate Functions
 - a. First-Order Condition & Stationary Points
 - b. Second-Order Conditions
- VIII. Unconstrained Optimization of Multivariate Functions
 - a. First-Order Conditions

- b. Positive & Negative Definite Matrices
- c. Positive & Negative Semi-Definite Matrices
- d. Second Order-Conditions

Application: relative maxima and minima.

- IX. Constrained Optimization
- a. Solving with Substitution
 - b. Solving with a Lagrangian function
 - c. The Envelope Theorem
 - d. The Bordered Hessian
 - e. Second-Order Conditions

Application: Utility maximization and a budget constraint. (Slutsky equation), Iso-cost and the output maximization.

- X. Integral Calculus
- a. Fundamental Theorem of Calculus
 - b. Economics & Finance Applications

Application: Time value of Money: PV, FV, Amortization and other personal finance calculations.

FINAL EXAM/PAPER DATE AND TIME

Online Final exam Schedule: <http://finalexams.rutgers.edu/>

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- all student work is fairly evaluated and no student has an inappropriate advantage over others.
- the academic and ethical development of all students is fostered.
- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

STUDENT WELLNESS SERVICES

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlisteners>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.