University of Wisconsin-Whitewater

Curriculum Proposal Form #3

## New Course

**Effective Term:**

**Subject Area - Course Number:** **ECON 738 Cross-listing:**

(See Note #1 below)

**Course Title:** (Limited to 65 characters) Quantitative Methods in Economics

**25-Character Abbreviation:** Quant Methods in Econ

**Sponsor(s):** Yamin Ahmad

**Department(s):** Economics

**College(s):**

# **Consultation took place**: [x]  NA [ ]  Yes (list departments and attach consultation sheet)

Departments:

**Programs Affected:** **None**

**Is paperwork complete for those programs?** (Use "Form 2" for Catalog & Academic Report updates)

[x]  NA [ ]  Yes [ ]  will be at future meeting

**Prerequisites:** Entry into MS Economics Program

**Grade Basis:** [x]  Conventional Letter [ ]  S/NC or Pass/Fail

**Course will be offered:** [x]  Part of Load [ ]  Above Load

 [x]  On Campus [ ]  Off Campus - Location

**College:**  **Dept/Area(s):** ECON

**Instructor:** Yamin Ahmad

 *Note: If the course is dual-listed, instructor must be a member of Grad Faculty.*

**Check if the Course is to Meet Any of the Following:**

[ ]  Technological Literacy Requirement [ ]  Writing Requirement

[ ]  Diversity [ ]  General Education Option:

Note: For the Gen Ed option, the proposal should address how this course relates to specific core courses, meets the goals of General Education in providing breadth, and incorporates scholarship in the appropriate field relating to women and gender.

**Credit/Contact Hours:** (per semester)

Total lab hours: 0 Total lecture hours: 48

Number of credits: 3 Total contact hours: 48

**Can course be taken more than once for credit? (Repeatability)**

[x]  No [ ]  Yes If "Yes", answer the following questions:

No of times in major:       No of credits in major:

No of times in degree:       No of credits in degree:

Proposal Information: ([***Procedures for form #3***](http://acadaff.uww.edu/UCC/Curriculum_Handbook_09/Procedures_form3.docx))

**Course justification:**

This proposed course will be a one of the core courses that students entering the MS Economics programs will be required to take. It will expose the student to the kind of mathematics that they will need to know in order to be able to pursue the MS Economics degree.

**Relationship to program assessment objectives:**

Since this course will be one of the core courses of the MS Economics degree, all students entering the MS Economics program will be required to take this course. In doing so, it will familiarize all students in the use of mathematics in graduate economics.

One of the key objectives of the MS Economics degree is to allow students to gain Quantitative and Statistical Proficiency. This course addresses the Quantitative Proficiency aspect of this Learning objective and the specific student learning outcomes (traits) that this course will address are:

* Students are able to utilize multivariate calculus in the study of economic problems.
* Students are able to utilize differential calculus in the analyzing economic problems.
* Students are able to utilize linear algebra in the analysis of economic problems.

**Budgetary impact:**

* **Staffing**:- the course will be staffed by a Economics Department faculty that is Academically Qualified (AQ) and has Grad Faculty status.
* **Academic unit library and service & supply budget:** - no budgetary impact.
* **Campus instructional resource units**:- impact is minimal; students will require the use of Matlab (- a 4th generation computing language) in the course, and Matlab is available in the General Access labs in the Library and McGraw. In addition, Matlab is available in the computer labs in Hyland Hall where the course is anticipated to take place.
* **Laboratory/studio facilities:**- No budgetary impact
* **Classroom space:**- A classroom is anticipated to be required in Hyland Hall to teach the class. The class will meet for 1hour 15 minute session, twice per week.
* **Evaluation of adequacy of current library holdings, recommendations for acquisitions, and impact of the course on the academic unit library allocation budget:** - No impact. The course will be taught using a graduate textbook which students will be required to obtain.
* **Explanation if the course is simply replacing another course, either entirely or in the cycle:**- This is a new course for the MS Economics degree, and does not replace any other courses.

**Course description:** (50 word limit)

This course will provide students with the mathematical methods and tools used in modern economic analysis. Linear algebra, multivariable calculus, and optimization theory are the main topics of the course and applications to simple economic models will be emphasized. Pre-requisites are entry into the MS Economics program.

**If dual listed, list graduate level requirements for the following:**

1. **Content** (e.g., What are additional presentation/project requirements?)

N/A

2. **Intensity** (e.g., How are the processes and standards of evaluation different for graduates and undergraduates? )
N/A

3. **Self-Directed** (e.g., How are research expectations differ for graduates and undergraduates?)
N/A

**Course objectives and tentative course syllabus:**

**ECON 706 Fall 2014**

**Quantitative Methods in Economics Yamin S. Ahmad**

Office: 4402 Hyland Hall, Tel: x5576, Email: ahmady@uww.edu

***Office Hours***

Walk in: MW 2:00pm – 5:00pm; Email: F 9am – 11am; and by appointment.

**Course Web Page:** <http://facstaff.uww.edu/ahmady/courses/econ706/>

This is the web page for the course. Here you can find the course schedule, lecture notes, problem sets and more.

**Prerequisites**

Entry into the MS Economics Degree

In this course, we will be using mathematics extensively. In particular, you should be able to algebraically manipulate and solve equations. If you have taken prior courses in calculus, you will find it beneficial to review calculus concepts such as partial and total derivatives.

**Required Resources**

1. Required Text: *Fundamental Methods of Mathematical Economics*, by Alpha Chiang and Kevin Wainwright, 4th Edition, 2005, McGraw Hill. ISBN: 0-07-010910-9.
2. Recommended Text: *Mathematics for Economists*, by Simon and Blume, 1994

Other useful texts or sources you may wish to look at:

* *Methods for Economics*, by Michael Klein, 2nd Edition, 2002, Addison Wesley/Prentice Hall. ISBN: 0201726262
* *A First Course in Optimization Theory*, by Rangarajan K. Sundaram, 1999 – A more theory orientated book that covers the ideas behind optimization theory.
* *Principles of Mathematical Analysis*, by Rudin, 1976 – A book which gives a good grounding in Real Analysis.
* *Elementary Linear Algebra*, by Anton, 1991.

**Course Description Objectives and Assessment**

This course is a course in mathematical economics that is intended to provide a preview of the technical rigors involved in graduate studies. As such, this course will provide students with the mathematical methods and tools used in modern economic analysis and will expose the student to the use of applied mathematics in solving economic problems. We will explore advanced techniques used to study both microeconomic and macroeconomic problems, whilst consolidating the mathematical techniques needed for graduate work. Students who take this course will have a good grounding in its main topics: linear algebra, multivariate calculus, optimization theory and difference and differential equations. In addition, the course will provide an introduction to Matlab, a fourth generation programming language that uses matrices, which we will use to aid in solving economic problems. Matlab is available for use in the GA lab computers in McGraw and Anderson, and in the computer labs in Hyland Hall.

**Course Requirements and Grading**

This course has the following requirements which will be used to assign you a grade at the end of the semester. There will be computational assignments (involving you using Matlab to solve the assignments), four quizzes, a midterm exam and a final exam. Dropping the lowest quiz score, the remaining quizzes are worth 10 percent each, the midterm is worth 30 percent and the final exam is worth 30 percent. Your total score on the computational assignments are worth 10% of the grade.

 Weight

Computing Assignments 10 %

Quizzes Best 3 x 10% (each) = 30 %

Midterm Exam 30 %

Final Exam 30 %

 100 %

**A Note on Letter Grades**:

As a general guideline, grades will be assigned based on the raw scores from the grading scheme above as follows:

A: >=86 C+: 66-69

A-: 82-85 C: 62-65

B+: 78-81 C-: 56-61

B: 74-77 D: 50-55

B-: 70-73 F: <50

**Please note that the scale above is only an approximation**. I will curve the raw scores obtained from the grading scheme above at the very end of the semester.

**Attendance Policy**

Enrollment in this course is taken as a commitment from you that you have made room in your life to fulfill the obligations of this course - coming to class, being there for exams when they are scheduled, etc.  I will not record attendance, but you will find yourself at a significant disadvantage if you miss class.  **It is the student’s responsibility to obtain any materials or information missed due to absence.**

**Advice**

The key piece of advice that I would say to you is to make sure you spend sufficient time trying to grasp the ideas that are being presented in class and in the papers you will read. These ideas are often complex and it takes time to fully grasp the issue at hand. You may find it useful as well to attend my office hours with any questions that you have. However, if you choose to use office hours, please come prepared with a list of questions, as that will probably allow us to use the time more effectively.

There is a lot of math in this course**. If you get stuck or feel like you’re falling behind, talk to your peers and do come use my office hours!** Come and see me if you have any questions whatsoever, be it about the material, or some concept you haven’t fully grasped yet. It will be easier for me to put you on the right track rather than have you struggle through something that you do not understand.

**Policy Statement**

*The University of Wisconsin-Whitewater is dedicated to a safe, supportive and non-discriminatory learning environment.  It is the responsibility of all undergraduate and graduate students to familiarize themselves with University policies regarding Special Accommodations, Misconduct, Religious Beliefs Accommodation, Discrimination and Absence for University Sponsored Events.  (For details please refer to the Undergraduate and Graduate Timetables; the “Rights and Responsibilities” section of the Undergraduate Bulletin; the Academic Requirements and Policies and the Facilities and Services sections of the Graduate Bulletin; and the “Student Academic Disciplinary Procedures” [UWS Chapter 14]; and the “Student Nonacademic Disciplinary Procedures” [UWS Chapter 17].*

**UWW Student Honor Code**

*As members of the University of Wisconsin – Whitewater College of Business & Economics community, we commit ourselves to act honestly, responsibly, and above all, with honor and integrity in all areas of campus life.  We are accountable for all that we say and write.  We are responsible for the academic integrity of our work.  We pledge that we will not misrepresent our work nor give or receive unauthorized aid.  We commit ourselves to behave in a manner that demonstrates concern for the personal dignity, rights and freedoms of all members of the community.  We are respectful of college property and the property of others.  We will not tolerate a lack of respect for these values.*

*This code originated at Wheaton College.*

**Course Outline and Reading List**

This course outline is tentative and I reserve the right to amend the schedule as I see fit. These changes will be announced in class and posted on the course webpage. We will cover as many topics as time permits, which in turn will depend on the pace of the class.

## 1: Introduction

Introduction: Notation and basic set theory; functions.

## 2: Linear Algebra

Topics in Linear Algebra include:

Systems of equations and matrices; Gauss-Jordan Elimination; Matrix Algebra; Formal definition of a matrix. Symmetric Matrices. Row space, column space and null space. Rank and nullity. Fundamental Theorem of Linear Algebra. Determinants. Cramer’s Rule; Definiteness of a matrix.

## 3. Euclidean Spaces

Topics in Euclidean Spaces include:

Vectors. Inner Product. Distance between vectors; Vector Spaces (Euclidean Spaces) and Subspaces; Hyperplanes. Budget Sets and Simplexes; Linear Combinations and Spanning Sets; Linearly Independent Sets. Basis and Dimension. Eigenvalues and Eigenvectors.

## 4. Multivariate Calculus

Topics in Multivariate Calculus include:

Differentiation at a point. Partial Differentiation. Gradients and directional derivatives. Derivative matrix (Jacobian). Differentiation and continuity. The Chain Rule. Higher order derivatives. Young’s Theorem. Hessian Matrix. Implicit Differentiation and the Implicit Function Theorem.

## 5. Optimization

Topics in optimization include:

Quadratic Forms; Definiteness of Quadratic Forms; Local vs. absolute maximum; Unconstrained Maximum; Constrained local maximum. Kuhn-Tucker optimization. Convexity and concavity. Concavity and optimization. Quasiconcavity and quasiconvexity. The Envelope Theorem. The Envelope Theorem with constrained optimization.

## 6. Difference and Differential Equations

Topics include:

Introduction to differential equations and boundary value problems. Higher-order differential equations. Lag and difference operators. Linear first-order difference equations. Boundary conditions. ARMA representations.

## 7. Dynamic Optimization

Topics include:

Calculus of Variations; Euler equations; Boundary Conditions; Transversality condition. Introduction to Optimal Control Theory; The Maximum Principle; State variables, Controls, and Laws of Motion; Hamiltonian Functions.

## 8: Real Analysis (Time Permitting)

Topics in Real Analysis include: Ordered Sets. Upper and Lower Bounds. Supremeum and infimium. Metrics and distance functions. Neighborhoods, interior and limit points. Open and Closed Sets. Bounded Sets. Interior and Closure of a set. Compact and Connected Sets. Sequences, subsequences. Cauchy Sequences. Series, geometric series.

**Tentative Schedule**

Week 1: Introduction

Week 2 – 5: Linear Algebra

Week 6 – 7: Euclidean Spaces

Week 8 – 9: Multivariate Calculus

Week 10 – 12: Optimization Theory

Week 13 – 14: Difference and Differential Equations

Week 15: Dynamic Optimization; Real Analysis (Time Permitting)

**Bibliography:** (Key or essential references only. Normally the bibliography should be no more than one or two pages in length.)

1. Required Text: *Fundamental Methods of Mathematical Economics*, by Alpha Chiang and Kevin Wainwright, 4th Edition, 2005, McGraw Hill. ISBN: 0-07-010910-9.
2. Recommended Text: *Mathematics for Economists*, by Simon and Blume, 1994
3. *Methods for Economics*, by Michael Klein, 2nd Edition, 2002, Addison Wesley/Prentice Hall. ISBN: 0201726262
4. *A First Course in Optimization Theory*, by Rangarajan K. Sundaram, 1999
5. *Principles of Mathematical Analysis*, by Rudin, 1976
6. *Elementary Linear Algebra*, by Anton, 1991.