University of Wisconsin-Whitewater

Curriculum Proposal Form #3

## New Course

**Effective Term:**

**Subject Area - Course Number:** **COMPSCI 347 Cross-listing:** **N/A**

(See Note #1 below)

**Course Title:** (Limited to 65 characters) Scientific Computing

**25-Character Abbreviation:** Scientific Computing

**Sponsor(s):** Sobitha Samaranayake & Jonathan Kane

**Department(s):** Mathematical and Computer Sciences

**College(s):**

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

Departments:

**Programs Affected:** **Computer Science**

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

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

**Prerequisites:** Math 254

**Grade Basis:** [x]  Conventional Letter [x]  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):** Math and Computer Sciences

**Instructor:**

 *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 course is designed to provide students in the sciences and Computer Science the tools to do numerical calculations with a computer. It provides training requested by various science departments in the College of Letters and Sciences. Students will learn how to use computer packages to perform numerical calculations as well as learn how to solve some commonly occurring numerical problems. Computer Science majors and minors will find this course useful preparation for a career in industry. This course has recently been taught successfully as a Special Studies course. Students who at one time might have taken the recently deleted COMPSCI 173 Introduction to FORTRAN course will find this course better fitting their needs.

**Relationship to program assessment objectives:**

This course will serve two audiences. First it will give Computer Science majors and minors experience with industrial applications of computers helping to prepare these students to follow careers as programming specialists in scientific and industrial settings. Second it will give science majors training in the use of computational tools common to their disciplines and exposure to common numerical problems that occur in the sciences. The Assessment Committee in the Department of Mathematical and Computer Sciences has identified 5 universal objectives that address cognitive processes involved in learning math and computing topics. They are Analytical Reasoning, Conceptual/Foundational Understanding, Pattern Recognition, Problem Solving, and Synthesis. Adding the course “Scientific Computing” will help strengthen three of these assessment objectives. Specifically,

(1) Analytical Reasoning – students will get extensive training in how to perform calculations using standard computer packages. Students will gain experience selecting appropriate tools to apply to a wide range of problems.

(2) Pattern Recognition - this course helps students to see standard problems stated in a variety of ways. Students will need to recognize similarities between a stated problem and other standard problems.

(3) Problem solving - is the main emphasis of the course. Students will be shown several standard numerical problems and trained in the techniques used to solve them.

**Budgetary impact:**

This course has been taught for the last two years as a Special Topics course. It will be integrated into the department’s course rotation schedule to be taught one time each year. It will play a role in the proposed Computer Science major. There will be three new courses introduced for that major, and the department will cover these courses as part of its load. These new courses will require between three to four additional course sections being offered each year as part of the new major, and the half FTE required will be covered by a promised new half FTE from the College of Letters and Sciences. Computer laboratory space on campus is already sufficient to run this course. The Computer Science budget is being increased slightly to cover any new software required.

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

This course provides basic tools for numerical computation within a scientific context. It focuses on the development and implementation of numerical algorithms and visualization of complex data sets. Numerical methods include roots of nonlinear equations, linear systems, eigenvalue problems, numerical integration, initial value problems, and data fitting. MATLAB is used.

THIS IS A COURSE SYLLABUS USED WHEN THIS COURSE WAS TAUGHT AS A SPECIAL STUDIES COURSE IN SPRING 2010.

**Course**: COMPSCI 347 Scientific Computing

**Text Book**:

**This textbook can be rented at the bookstore**: Numerical Analysis by Burden,R. & Faires, J

**This textbook must be purchased & will be the primary text**: Introduction to MATLAB for Engineers by William J. Palm III, 3rd edition

**Goals**: Students will learn to use MATLAB to solve a variety of numerical problems common in mathematics and the physical sciences. This will involve learning some elementary computer programming skills and the basics of numerical calculations. Students will apply these skills to graphing equations, solving systems of linear equations, finding roots of nonlinear equations, finding numerical approximations to integrals, solving differential equations, and solving eigenvalue problems.

**Tentative Topic Coverage**:

Program control flow 2 weeks

Structured arrays 1 week

Advance plotting 1 week

Solving linear systems 2 weeks

Finding roots of nonlinear equations 1 week

Eigenvalue problem 2 weeks

Numerical integration 2 weeks

Solving differential equations 2 weeks

Applications 2 weeks

**Prerequisite**: MATH 253 and 254 or consent of the instructor

**Course Description**:

This course provides the applied scientist with the basic tools needed to perform computing within a scientific context. The computational aspects focus on two major areas: (1) the development and implementation of numerical algorithms in computer programs, and (2) the analysis and visualization of complex data sets. The numerical methods covered include finding roots of nonlinear equations, solving linear systems, the eigenvalue problem, numerical integration, the initial value problem, and data fitting. The high-level computer language used is Matlab.

**Grading**:

60%: In class assignments and take-home projects

30%: 2 in-class examinations (15% each)

10%: Comprehensive Final Exam

**Final Exam**: Wednesday, May 12, 2010 1:00 – 3:00 pm

**Grading Policy:** Final grade will be determined as follows.

A: 93 – 100% A- : 90 – 92.9%

B+: 87 – 89.9% B : 83 – 86.9% B- : 80 – 82.9%

C+: 77 – 79.9% C : 73 – 76.9% C- : 70 – 72.9%

D+: 67 – 69.9% D : 63 – 66.9% D- : 60 – 62.9%

F: 0 – 59.9%

Cell Phones: Cell phones must be turned off during every class period.

**Attendance**:

 You are expected to attend all class periods. See me, in my office, in the event of an extended absence. If you know you will be absent the day of an exam for an unavoidable reason, please contact me in advance to make arrangements to take the exam.

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

Burden, R. L. and Faires, J. D. Numerical Analysis, 7th ed., Brooks/Cole,

California, 2001.

Chapra, S. C., Applied Numerical Methods with Matlab, 2nd ed., McGraw

Hill, New York, 2008.

Chapra, S. C. and Canale, R. P., Numerical Methods for Engineers, 6th ed.,

McGraw-Hill, New York, 2010.

Fausett, L. V., Applied Numerical Analysis Using Matlab, Pearson/PrenticeHall,

New Jersey, 2008.

Hanselman, D. and Littlefield, B., Mastering Matlab 7, Prentice Hall, New

Jersey, 2005.

Magrab, E., et. al., An Engineer's Guide to Matlab, Prentice Hall, New Jersey,

2000.

Palm, W. J., Introduction to MATLAB for Engineers, McGraw Hill, New York, 2011