LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		~~09-36f.~~ 10 9d.	R 9/28/10 App 10/26/10 R-11/17/09	

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
Francisco Alarcón	falarcon@iup.edu
Proposing Department/Unit	**Phone**
Mathematics	724-357-2608

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_X_ New Course _____ Course Prefix Change _____ Course Deletion

_____ Course Revision _____ Course Number and/or Title Change _____ Catalog Description Change

	MATH 450 Topics in Applied Computational Mathematics
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_X_ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____ Catalog Description Change _____ Program Revision

_____ New Degree Program _____ Program Title Change _____ Other

_____ New Minor Program _____ New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)	Kimberly J Burdi	4/22/09
Department Chair(s)		4/21/09
College Curriculum Committee Chair		10/16/09
College Dean	Mary Sandy	10/19/09
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S Sechrist	10/26/10

* where applicable

Received OCT 11 2010 Liberal Studies

Received SEP 22 2010 Liberal Studies

Received OCT 2009 Liberal Studies

Part II. Description of Curricular Change

1. Syllabus of Record

I. CATALOG DESCRIPTION

MATH 450 Topics in Applied Computational Mathematics **3c-0l-3cr**
Prerequisites: MATH 171, 225, and COSC/MATH 250 or permission of instructor

Focuses on using computational methods to solve applied mathematics problems. Content will vary from year to year. Students will gain experience in solving practical problems, using various mathematical software packages, giving oral presentations, preparing technical reports, reading field-related journals and integrating scientific visualization.

II. COURSE OUTCOMES

Students will be able to

1. analyze advanced numerical methods and write the outcomes of computer simulations and experimentations as formal reports
2. incorporate scientific visualization with numerical methods to solve computational mathematics problems
3. utilize mathematical/statistical software packages (e.g. Mathematica, Matlab, LINGO, etc.) to solve computational mathematics problems
4. construct computer programs in an appropriate language (e.g. C++, Matlab) to solve computational mathematics problems
5. critique field-related journal articles and write review-style summaries utilizing and incorporating feedback from rough drafts
6. utilize specialized typesetting packages for equations and diagrams to write technical professional reports
7. prepare and present cumulative oral reports on computational mathematics topics and submit detailed written outlines

III. COURSE OUTLINE

Course content is subject to change but must focus on using computational methods to solve mathematical problems. Individual course proposals will be reviewed by the Math/Applied Math Curriculum Committee.

Course outline for one of the various topics choices:
Nonlinear Optimization with Financial Applications

A. Introduction to Types of Optimization — 3 academic hours
   i) Linear/Nonlinear Optimization
   ii) Integer Optimization
   iii) Optimization Software Packages

B. Portfolio Optimization — 3 academic hours
   i) Optimizing two-asset portfolios
   ii) Minimum risk problems and maximum return problems

C. One-variable optimization — 3 academic hours
   i) Optimality conditions
   ii) Review of the bisection method, the secant method, and Newton's method
   iii) Review of Quadratic or cubic interpolation

D. Unconstrained Optimization — 6 academic hours
   i) Optimality conditions
   ii) Visualizing problems in several variables
   iii) Global Unconstrained Optimization

E. The Steepest Descent Method — 3 academic hours
   i) Linear Searches
   ii) Convergence of the steepest descent method
   iii) Numerical results with steepest descent
   iv) Wolfe's convergence theorem

F. Newton's Method — 6 academic hours
   i) Quadratic models and the Newton step
   ii) Positive definiteness and Cholesky factors
   iii) Advantages & drawbacks of Newton's method
   iv) Search directions from indefinite Hessians
   v) Quasi-Newton Methods

G. Optimal portfolios with restrictions and Larger-scale portfolios — 6 academic hours

H. Constrained optimization — 3 academic hours
   i) Equality Constraints
   ii) Inequality Constraints

I. Interior Point Methods — 3 academic hours

This syllabus leaves 8 academic hours for one exam and students' presentations. Presentations will also occur during the final exam period.

IV. EVALUATION METHODS

Each of the following elements must be evaluated in all offerings of this course:

1. Use of scientific visualization and interpretations
2. Quality of reports integrating equations and diagrams
3. Quality of oral presentations
4. Knowledge of some area of computational mathematics

Final course grade is determined as follows:

15% One Major Content Examination

55% Writing Assignments including: Preliminary Abstract and Non-technical Reports (15%), Project Proposal (5%), Technical Report (15%), Journal Article (15%), and Peer Review and Critique (5%).

10% Oral Presentations

20% Computer Assignments and In-class Quizzes

V. GRADING SCALE:

A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60%

VI. ATTENDANCE POLICY:

The course attendance policy will be consistent with the University policy.

VII. REQUIRED READINGS (Example):

Michael Bartholomew-Biggs, Nonlinear Optimization with Financial Applications. Spring, 2005.

VIII. SPECIAL RESOURCES OR REQUIREMENTS

None.

IX. BIBLIOGRAPHY

1. Gregoire Allaire and Alan Graig. Numerical Analysis and Optimization: An Introduction to Mathematical Modelling and Numerical Simulation (Numerical Mathematics and Scientific Computation). Oxford University Press, 2007.
2. Mokhtar S. Bazaraa, Hanif D. Sherali, and C. M. Shetty. Nonlinear Programming: Theory and Algorithms. Wiley-Interscience, 2006.
3. Paolo Brandimarte. Numerical Methods in Finance and Economics: A MATLAB-Based Introduction (Statistics in Practice). Wiley-Interscience, 2006.
4. Gerard Cornuejols and Reha Tutuncu. Optimization Methods in Finance (Mathematics, Finance and Risk). Cambridge University Press, 2007.
5. Jeffery J. Leader. Numerical Analysis and Scientific Computation. Addison Wesley, 2004.
6. Salif N. Neftci. Principles of Financial Engineering. Academic Press, 2004.
7. Jorge Nocedal and Stephen Wright. Numerical Optimization. New York: Springer, 2006.

Course Analysis Questionnaire

Section A: Details of the Course

A1. How does this course fit into the programs of the department? For which students is the course designed? (majors, students in other majors, liberal studies). Explain why this content cannot be incorporated into an existing course.

This course synthesizes content from several core applied mathematics courses. These individual courses have narrow, in-depth focus and do not have the breadth of content to allow inclusion of significant real world problems which typically span several mathematical areas. This course is designed for junior/senior Applied Mathematics students to strengthen their ability to work as mathematicians in business and industry.

A2. Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

No.

A3. Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students).

No.

A4. Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.

No

A5. If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

This course will not be offered for variable credit.

A6. Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).

University of Colorado, Boulder
APPM 4720 Open Topics in Applied Mathematics
Provides a vehicle for the development and presentation of new topics that may be incorporated into the core courses in applied mathematics. Prereqs., variable, depending on topic -- see instructor. Same as APPM 5720. Semester offered: Spring.

University of Notre Dame
434. Topics in Applied Mathematics
Topics in analytic and numerical methods applied to problems in mechanics, electrostatics and heat flow.

Florida Institute of Technology
MTH 4920 - Spc Top in Applied Math
Special Topics in Applied Math (3 credits). Selected topics from mathematics. Content varies from year to year depending on the needs and interests of the students and expertise of the instructor. (Prerequisite: Permission of the instructor.)

MTH 4930 - Spc Top Computational Math
This course will cover selected topics from computational mathematics. Content will vary from year to year depending on the needs and interests of the students and special expertise of the instructor.

Laurentian University
MATH 4376 E Topics in Applied Mathematics I
This course presents selected topics in applied mathematics. Prerequisite: Permission of the instructor.

MATH 4377 E Topics in Applied Mathematics II
This course presents selected topics in applied mathematics. Prerequisite: Permission of the instructor.

A7. Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.

The content and skills of this proposed course are recommended by two professional societies.

Society for Industrial and Applied Mathematics (SIAM) Report on Mathematics in Industry
The Mathematical Association of America- MAA Notes #61- Changing Core Mathematics
The Mathematical Association of America-Undergraduate Programs and Courses in the Mathematical Sciences: CUPM curriculum Guide 2004

Section B: Interdisciplinary Implications

B1. Will this course be taught by instructors from more than one department or team taught within the department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

It might be team taught within the department. The team will propose the course to the Math/Applied Math curriculum committee. The committee will review for its appropriateness.

B2. What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).

COSC/MATH 250 covers introduction to numerical methods and MATH 450 will build upon contents from COSC/MATH 250. COSC 450 surveys advanced numerical methods. MATH 450 focuses on computational mathematics topics utilizing specific numerical methods with applications and problem solving process emphases.

B3. Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.

No.

B4. Will seats in this course be made available to students in the School of Continuing Education?

No.

Section C: Implementation

C1. Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated workload will be assigned for this course.

Faculty resources are adequate. The Mathematics Department has an upper level course rotation policy and this course would fit in that rotation every other spring semester, where we currently offer various upper level electives. In this new rotation we will strengthen the applied mathematics program and a different upper level mathematics course may not be offered. However, enough upper level courses are offered in that program.

C2. What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

*Space
*Equipment
*Laboratory Supplies and other Consumable Goods
*Library Materials
*Travel Funds

None.

C3. Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

No.

C4. How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

This course will be offered every other spring semester.

C5. How many sections of this course do you anticipate offering in any single semester?

1 section.

C6. How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?

20.

C7. Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

No.

C8. If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.

N/A

Section D: Miscellaneous

Include any additional information valuable to those reviewing this new course proposal.

Letter of Support

Computer Science Department

-----Original Message-----
From: Charles Shubra [mailto:cjshubra@iup.edu]
Sent: Friday 20 March 2009 2:35 PM
To: kjburch@iup.edu
Cc: Gary Stoudt
Subject: Math 450

Hi Kim,
I asked the computer science department curriculum committee to consider the Math 450 course syllabus which you provided. The Computer Science Department is happy to support the MATH 450 " Topics in Applied Computational Mathematics " course. This course will give further indepth knowledge to the students who already took COSC/MATH 250 course.

Thanks

Charles Shubra
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Gail S. Sechrist

From: "Kustim Wibowo" <kustim.wibowo@iup.edu>
To: "Francisco E. Alarcón" <falarcon@iup.edu>; "Gail S. Sechrist" <gailsech@iup.edu>; "Kustim Wibowo" <kustim.wibowo@iup.edu>
Cc: "'Alarcon, Francisco E'" <Francisco.Alarcon@iup.edu>; <hydem@iup.edu>; <mohhali@iup.edu>
Sent: Monday, October 18, 2010 8:35 PM
Subject: Re: New Mathematics Course MATH 450

Francisco,

Thank you for notifying MIS/DS department of the Math-450 new course proposal. I believe your observation is accurate that there are insignificant overlap between Math450 and QBUS215 and it is impossible for students needing to take QBUS 215 to take Math450. MIS/DS department gladly supports the proposal.

Best regards,
Kustim

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Kustim Wibowo, Ph.D.
Professor and Chair of MIS & Decision Sciences Department
203 Eberly College of Business and Information Technology
Indiana University of Pennsylvania, Indiana, PA 15705
phone: 724-357-5773, fax: 724-357-4831
website: http://www.eberly.iup.edu/kwibowo
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On Tue, 12 Oct 2010 11:46:29 -0400
Francisco E. Alarcón <falarcon@iup.edu> wrote:
> Kustim,
>
> My understanding is that there was some concern expressed by Miki
>Hide about
> one of our new courses, MATH 450 Topics in Applied Computational
> Mathematics, as some of the course content seems to overlap with
>some of the
> content in QBUS 215. I am not thoroughly familiar with the course
>content of
> QBUS 215, but there seems to be very little overlap.
>
> The overlap seems to be with linear programming. From the catalog
>(QBUS
> 215):
>
> Expands upon the probabilistic concepts developed in MATH
> 214 to orient the student toward managerial decision making using
> quantitative methodologies. Topics covered include classical
>regression
> analysis, forecasting, Bayesian decision theory, linear programming,
>and
> simulation.
>
> MATH 450 does cover Linear Optimization and linear programming, as
>well as
> many other optimization techniques: Nonlinear, unconstrained
>optimization,
> and others. Pre-requisites for MATH 450 are MATH 171, MATH 225 and
>MATH/COSC