LSC Use Only
Number: _____
Submission Date: _____
Action-Date: _____

RECEIVED
NOV 13 2000
LIBERAL STUDIES

UWUCC USE Only
Number: 00-406
Submission Date: _____
Action-Date: UWUCC ~~Apr~~ 3/13/01
Senate Apr 4/3/01

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Gerald Buriok Phone 7 2608

Department Mathematics

II. PROPOSAL TYPE (Check All Appropriate Lines)

MATH115 **COURSE** Applied Math for Bus
Suggested 20 character title

X New Course* MATH115 Applied Mathematics for Business
Course Number and Full Title

____ Course Revision _____
Course Number and Full Title

X Liberal Studies Approval + for new or existing course MATH115 Applied Mathematics for Business
Course Number and Full Title

Rev.

RECEIVED
FEB 27 2001
LIBERAL STUDIES

____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

____ Course or Catalog Description Change _____
Course Number and Full Title

_____ **PROGRAM:** _____ Major _____ Minor _____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Gary Stoudt
Department Curriculum Committee

Gerald Buriok 10/27/00
Department Chair

College Curriculum Committee

11/3/00
College Dean

Mary Haller 11-16-00
+Director of Liberal Studies (where applicable)

*Provost (where applicable)

I. Catalog Description

MATH 115 Applied Mathematics for Business

4 lecture hours
0 lab hours
4 credits
(4c-0l-4sh)

Prerequisites: MATH 105 or appropriate Placement Test Score or permission of the Mathematics Department chairperson.
Note: A student may not take MATH 115 after successfully completing a calculus course without the written approval of the mathematics department chairperson.

The course offers a review of elementary functions including logarithmic and exponential functions. Business majors are introduced to the mathematics of finance and central ideas of the calculus, including limit, derivative, and integral. Applications to business and economics are emphasized.

II. Course Objectives

Students will be able to:

1. apply pattern recognition to the study of mathematics;
2. understand the concept of function and applications of functions in business and economics;
3. develop and apply formulae applicable to the mathematics of finance;
4. interpret functions expressed analytically and graphically;
5. understand the limit process and how it pertains to functions in business and economics;
6. calculate the derivatives of common functions and interpret their meanings;
7. calculate the integrals of common functions and interpret their meanings;
8. demonstrate computational skills and knowledge of the conceptual mathematical framework necessary for the study of business and economics.

III. Course Outline

A. Library of Functions (10 hours)
   1. Functions
   2. Linear Functions
   3. Quadratic Functions
   4. Polynomial Functions
   5. Rational Functions
   6. Exponential Functions
   7. Logarithmic Functions

B. Mathematics of Finance (6 hours)
   1. Simple Interest
   2. Compound Interest
   3. Future Value of an Annuity
   4. Present Value of an Annuity

C. The Derivative (11 hours)
   1. Rates of Change
   2. Limits
   3. The Derivative
   4. Power Rules and Summation Rules
   5. Product and Quotient Rule
   6. Chain Rule: Power Form
   7. Marginal Analysis in Business and Economics

D. Graphing and Optimization (8 hours)
   1. Continuity and Graphs
   2. First Derivative and Graphs
   3. Second Derivative and Graphs
   4. Other Curve Sketching Techniques
   5. Optimization: Absolute Maxima and Minima

E. Additional Topics in Differentiation (5 hours)
   1. The Constant *e* and Continuous Compound Interest
   2. Derivatives of Exponential and Logarithmic Functions
   3. Chain Rule: General Form

F. Integration (8 hours)
   1. Antiderivatives and Indefinite Integrals
   2. Integration by Substitution
   3. Introduction to the Definite Integral
   4. The Fundamental Theorem of Calculus
   5. Applications of the Integral to Business and Economics

The remaining eight hours are for four review classes and four tests.

IV. Evaluation Methods

The final grade for the course will be determined as follows:

50% Tests. Tests will include problems on basic competency and critical thinking.
20% Final Examination. The final examination will be comprehensive and cover both basic competency and critical thinking.
30% Homework, Quizzes, and Projects. These will cover textbook assignments and applications to business and economics.

The final course grade will be determined using a grading scale approximately as follows:

90% and above, A; 80 - 89, B; 70 - 79, C; 60 - 69, D; below 60%, F.

V. Required Textbook

Barnett, Raymond, Michael Ziegler, and Karl Byleen. Applied Mathematics for Business, Economics, Life Sciences, and Social Sciences. Upper Saddle River, NJ: Prentice-Hall, Inc., 2000.

VI. Special Resource Requirements

Some instructors may require students to purchase a graphing calculator appropriate to the level of the course content.

VII. Bibliography

Committee on the Mathematical Sciences in the Year 2000. Everybody Counts: A Report to the Nation on the Future of Mathematics Education. Washington, DC : National Academy Press, 1989.

Haeussler, Ernest, and Richard Paul. Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences. Upper Saddle River, NJ: Prentice-Hall, Inc., 1999.

Hughes-Hallet, Deborah, et al. Applied Calculus. New York: John Wiley & Sons, Inc., 1999.

Course Analysis Questionnaire

Section A: Details of the Course

A1 How does this course fit into the programs of the department? For what students is the course designed? (majors, students in other majors, liberal studies)

> The Mathematics Department currently offers two calculus sequences, MATH123- MATH124 Calculus I and II for Physics, Chemistry and Mathematics, and MATH121-MATH122 Calculus for Business, Natural and Social Sciences. Students in the College of Business are currently required to complete MATH121, but the faculty of that College requested that a separate course be developed to replace MATH121 for their majors. The Mathematics Department will continue to offer MATH121 for students in Natural Sciences and Social Sciences.

A2 Does this course require changes in content of existing courses or requirements for a program?

> This course does not require changes in content of existing courses in the Mathematics Department or in the College of Business. Once the course is approved, the College of Business will modify their programs to require MATH115.

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.

> Discussions between the College of Business and the Mathematics Department have been going on for several years regarding the calculus and precalculus courses for their majors. There was tentative agreement on a syllabus for MATH115 during the fall semester of the 1999-2000 academic year, and six sections of the course under the number/title MATH281 Special Topics: Applied Mathematics for Business were offered during the spring semester 2000. Only students from the College of Business were permitted to register for MATH281, and College of Business students were not permitted to register for MATH121. Approximately 200 students enrolled in the six sections of MATH281.
>
> Six sections of MATH281 Special Topics: Applied Mathematics for Business were also offered during the fall semester of the 2000-2001 academic year, again enrolling approximately 200 students.

A4 Is this course to be a dual-level course?

> This course is not to be a dual-level course.

A5 If this course may be taken for variable credit, what criteria will be used to relate credits to the learning experience of the students?

This course may not be taken for variable credit.

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

The business school accreditation body, AACSB, specifies that the curriculum must contain mathematics and statistics, but does not specify course content. In checking catalogs from other SSHE institutions (California, Clarion, Shippensburg, Slippery Rock) and Penn State University, one typically finds college algebra or calculus required (equivalent to IUP's MATH105 College Algebra or MATH121 Calculus I for Business, Natural and Social Science), along with a probability and statistics course. Clarion and Shippensburg require a separate course in the mathematics of finance. None of the institutions surveyed offered the combination of college algebra, calculus, and mathematics of finance that appear in the proposal for MATH115.

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. Explain why this content or these skills cannot be incorporated into an existing course.

The content of the proposed course is not required by a professional society, accrediting authority, law, or external agency. The business school accreditation body, AACSB, specifies that the "...curriculum should include foundation knowledge for business in ...mathematics and statistics." This body does not recommend or require any particular course or content.

See attached memos from Dean Robert Camp and Professor Mohamed Albohali explaining the perceived mathematics needs of College of Business students and the shortcomings of the MATH121 course. MATH121 cannot be altered to accommodate business students without negatively affecting students from other majors (Natural and Social Sciences) who are required to take MATH121. Hence a new course is being proposed.

Section B: Interdisciplinary Implications

B1 Will the course be taught by one instructor or will there be team teaching?

The course will be taught by one instructor.

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 for these departments which clarify their attitudes toward the proposed changes.

There is no relationship between this course and the content of courses offered by other departments.
See attached memos from Dean Robert Camp and Professor Mohamed Alhohali.

B3 Will seats in this course be made available to students in the School of Continuing Education?

Yes, provided they are majors in programs in the College of Business.

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 schedules of current faculty. What will be taught less frequently or in fewer sections to make this possible?

Current faculty resources are adequate. The students who enroll in MATH115 would enroll in MATH121 if this new course was not available. Consequently, we will decrease the number of sections of MATH121 in correspondence with the number of sections of MATH115 that are offered. This worked well with the experimental course MATH281 in the spring and fall of 2000. Prior to that year, we had offered approximately ten sections of MATH121 each semester. During 2000, we offered six sections of MATH281 and four sections of MATH121 each semester.

C2 What other resources will be needed to this course and how adequate are the current resources?

No other resources will be needed to teach this course.

C3 Are any of the resources for this course funded by a grant?

None of the resources for this course will be funded by a grant.

C4 How frequently do you expect this course to be offered?

The Mathematics Department will offer this course every semester and during summer sessions.

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

Approximately six sections will be offered each semester.

C6 How many students do you plan to accommodate in a section of this course? Is this planned number limited by the availability of any resources. Explain.

Sections of MATH115 will accommodate approximately 35 students. This is based on the seating capacity of rooms in Stright Hall where all mathematics courses are taught.

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

The generally accepted maximum enrollment for courses of this type is approximately 30 students. A reference that gives this number is CROSSROADS IN MATHEMATICS - Standards for Introductory College Mathematics Before Calculus, published by the American Mathematical Association of Two-Year Colleges in 1995 (pg. 52).

Section D: Miscellaneous

No additional information.

IUP

Eberly College of Business & Information Technology
Indiana, Pennsylvania 15705

Date: August 17, 2000

To: Dr. Gail Sechrist, Chairperson
University-Wide Senate Undergraduate Curriculum Committee

From: Dr. Robert C. Camp, Dean

Re: Statement of Support for Math Department Proposal

Please accept this letter as a formal statement of support for the proposal by the Math Department for a course titled, "Applied Math for Business." When approved, this course will take the place of MA 121, which is required of all business majors. The revision is consistent with the fact that business students need foundation exposure to math finance concepts (primarily the time value of money), and somewhat less depth and breadth of exposure to calculus theory and applications. The Math Department offered the revised content in the Spring semester using the MA 281 course number. Dr. Buriok and one of the teachers of the pilot course reviewed their experience in teaching the revised course with the Eberly College Chairpersons this summer. Based on the results of that pilot, the Chairpersons in the College are in favor of the revision as submitted. Your approval of the new course will be appreciated.

Signed by:

Chairperson, Finance & Legal Studies — 8/25/00 Date

Chairperson, Management Department — 8/25/00 Date

Chairperson, Marketing Department — 8/25/2000 Date

Chairperson, MIS & Decision Sciences — 8/25/00 Date

Chairperson, Technology Support & Training — 8/25/00 Date

IUP

Eberly College of Business
Indiana, Pennsylvania 15705

Date: November 12, 1998

Subject: MA 121

To: Gerald Buriok, Chair
Mathematics Department

From: Robert C. Camp
Dean

As you certainly know, the calculus requirement for Business students has been a cause of great consternation since its implementation over a decade ago. As I recall, you and I have been involved personally in about three different group deliberations regarding the content and delivery of MA 121. Throughout these deliberations, the willingness of the Mathematics Department faculty to address our concerns has always been evident. In recent years, the Math Department cooperated in several ways, including segregation of Business students, alteration of prerequisite content, alteration of course content, and even deliberate selection of course instructors. All of the foregoing actions have been appreciated, but even collectively, they have not changed the situation.

During the current semester, the Eberly College of Business chairpersons, selected faculty, and I have had lengthy discussions about this matter. Our conclusion is that we have not properly defined what we need for our students. As a consequence, the course content has missed the target. In general terms, the expectations for the course are too broad and too deep. Some of the math concepts our students are studying provide marginal, if any, benefit. In addition, the depth of knowledge required for successful performance in MA 121 is often beyond what our students really need. We all know that we are not trying to make mathematicians out of our students. In fact, hardly any of our students will ever use calculus directly. Our sole objective in exposing students to calculus is to enhance their understanding of various business functions, most notably related to costs, revenues, and profits. The applications covered in MA 121 go far beyond this.

Given the foregoing, we propose that the MA 121 requirement be eliminated in favor of a totally redesigned course. That course would be titled "Applied Mathematics for Business" or "Quantitative Methods for Business." It would contain a substantial review of math fundamentals, a section on finite mathematics, including mathematics of finance, and a significantly reduced exposure to calculus.

As you know, MA 121 currently provides no exposure to the mathematics of finance.
Our students would benefit greatly from instruction in this area, since many of them will apply mathematics of finance concepts fairly routinely. By contrast, virtually none of them will utilize calculus directly.

We believe that an "Applied Mathematics for Business" course, as defined above, would be well received by our students. In addition, we believe that they would perform much more successfully in such a course. We would like to specify content, expectations, and textbook for this new course. We have a small committee working on these matters. The committee and I would like to meet with you and anyone else from the Mathematics Department you deem appropriate, in order to explore the proposed change.

On the separate issue of MA 214, the College of Business requests your cooperation in implementing our agreement regarding coverage of simple linear regression. You will recall that we requested the inclusion of simple regression in MA 214 so that we could rearrange our prerequisites to various courses in the College. Historically, QB 215 was required as a prerequisite to Finance I. As you know, MA 214 is a prerequisite to QB 215. Finance I contains topics which utilize regression analysis. Since both simple and multiple regression were required in QB 215, it was used as a prerequisite to Finance I. Because students had to take both courses before Finance I, it often delayed students from taking it in a timely way. Students have often tried to take Business Policy concurrent with Finance I, which should be taken ahead of Policy. In any event, you agreed to include simple linear regression in MA 214. Given this agreement, we changed the prerequisite on Finance I to simply be MA 214. It is our understanding that simple linear aggression is not being covered currently in MA 214. Your cooperation in getting statistics faculty to include this coverage is requested.

dms

Attachment

cc: Mark Staszkiewicz
John Eck
Manmohan Chaubey
ECOB Chairs
Mohamed Albohali

Memorandum

Eberly College of Business

Date: October 26, 1998

To: Dr. Robert C. Camp

From: Dr. Manmohan D. Chaubey MDC
Dr. Mohamed Albohali MHA

Subject: Calculus Requirement in Business Curriculum

Success in undergraduate programs in business requires an understanding of descriptive and analytical approaches to solving business problems. These cognitive skills are acquired primarily through the foundation courses, viz. the Liberal Studies program at IUP. Learning of Mathematics and Statistics is a part of the LS requirements for the ECOB students.

The contents of the foundations courses should be geared towards the needs of the students as they learn the functional area concepts in the upper division business courses. The analytical methods used in business disciplines are applications oriented. To encourage learning the content of the required mathematics course should be relevant to future business courses. The course should focus upon skills needed in analyzing business situations.

The present Mathematics requirement – MA121 – is a source of great dissatisfaction for ECOB students. Even the students who go through the route of MA100 to MA 105 to MA 121 find the course largely irrelevant. Their constant refrain "Do I need Calculus in this program?" has no easy answer. They do need the analytical techniques of calculus in economics, finance, production and operations management, and marketing. But the business discipline does not require the depth of understanding of differentiation and integration which the present MA121 requires. With this in mind, we propose that the Calculus for Business course incorporate the following characteristics:

1. A change in the present approach of "from theory to practice," to an applied one "from application to theory." This will help make the course more relevant to the students.

2. An increased, when compared to the present course, emphasis upon the review of fundamentals and on Finite mathematics.

3. A reduction in the emphasis, in terms of time spent, on derivatives and integration.

4. The topic of second and higher order derivatives should be covered only from the maximization, minimization and curve tracing point of view. These topics are covered in MA122.

5. The mathematics and calculus requirement in business should focus upon skills needed in analyzing business situations. only.

These recommendations are based upon extensive comments from business faculty and students over many years. We have also reviewed similar course offerings at many business schools. The curriculum of Business Calculus, at most business schools is designed to give the students the mathematical/analytical tools needed for success in functional and foundations area where mathematics is used.

Many available textbooks reflect our suggested approach to business calculus. Some of the textbooks that incorporate such a scheme are listed below.

Ernest F. Haeussler, Jr. and Richard S. Paul: Introductory Mathematical Analysis for Business, Economics and Life and Social Sciences. (9th Ed.), Prentice-Hall, 1999.

Raymond A. Barnett and Michael R. Ziegler: Applied Mathematics for Business, Economics and the Life and Social Sciences, (6th Ed.), Prentice-Hall, 1997.

Lial, Greenwell, and Miller: Finite Mathematics and Calculus with Applications, (5th Ed.), Addison Wesley Longman, 1998.

The following table gives a topical structure for such a course. Illustrative course outlines are enclosed.

Topics	Proposed No. of Class Hours	Text Chapter (Haeussler & Paul)	No. of Hrs. in MA121 now
Fundamentals			
Algebra Review	2	0	
Equations and Inequalities	2	1,2	
Graphs and Functions	3	3	4
Lines, Parabolas, and Systems	2	4	
Exponential and Logarithmic Functions	5	5	9
Finite Mathematics			
Systems of Linear Equations	3	4	
Mathematics of Finance	5	8	
Calculus			
The Derivative	8	12,-13	11
Application of Derivatives	8	15	15
Differentiating – Natural Logarithmic and Exponential Functions	3	13	
Integration	6	16	8
Application of Integration	3	17	3
Tests, etc.	6		6

We hope that the Department of Mathematics at IUP will adopt our recommendations and offer a Calculus course to business students that will serve the students' needs.

Thank you.

LIBERAL STUDIES COURSE APPROVAL, PARTS 1-3: GENERAL INFORMATION CHECK-LIST

I. Please indicate the LS category(ies) for which you are applying:

LEARNING SKILLS:

____ First Composition Course	____ Second Composition Course
✓ Mathematics	

KNOWLEDGE AREAS:

____ Humanities: History	____ Fine Arts
____ Humanities: Philos/Rel Studies	____ Social Sciences
____ Humanities: Literature	____ Non-Western Cultures
____ Natural Sci: Laboratory	____ Health & Wellness
____ Natural Sci: Non-laboratory	____ Liberal Studies Elective

II. Please use check marks to indicate which LS goals are primary, secondary, incidental, or not applicable. When you meet with the LSC to discuss the course, you may be asked to explain how these will be achieved.

Prim	Sec	Incid	N/A		
				A.	**Intellectual Skills and Modes of Thinking:**
✓				1.	Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process.
	✓			2.	Literacy--writing, reading, speaking, listening.
✓				3.	Understanding numerical data.
		✓		4.	Historical consciousness.
✓				5.	Scientific Inquiry.
			✓	6.	Values (Ethical mode of thinking or application of ethical perception).
			✓	7.	Aesthetic mode of thinking.
✓				**B.**	**Acquiring a Body of Knowledge or Understanding Essential to an Educated Person**
				C.	**Understanding the Physical Nature of Human Beings**
				D.	**Collateral Skills:**
		✓		1.	Use of the library.
	✓			2.	Use of computing technology.

III. The LS criteria indicate six ways that courses should contribute to students' abilities. Please check all that apply. When you meet with the LSC, you may be asked to explain your check marks.

____ 1. Confront the major ethical issues which pertain to the subject matter; realize that although "suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.

✓ 2. Define and analyze problems, frame questions, evaluate available solutions and make choices.

✓ 3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.

✓ 4. Recognize creativity and engage in creative thinking.

✓ 5. Continue learning even after the completion of their formal education.

✓ 6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

LIBERAL STUDIES COURSE APPROVAL, PARTS IV.

A. There is a common syllabus of topics that are covered by each of the instructors teaching this course. This syllabus includes, but is not limited to, topics which introduce students to deductive reasoning, develop problem solving skills, and enable students to understand the underlying principles of formulae, and use and interpret numerical data. The Mathematics Department has a Service Courses Committee, which oversees the content and methodology in a collection of non-majors courses, including MATH115.

B. Whenever appropriate, information will be introduced which will reflect the contributions made to mathematics by women and racial minorities.

C. The Mathematics Department wishes to exercise the exception and claim that the primary purpose of this course is the development of higher level quantitative skills. The syllabus for MATH115 was developed to prepare students in the College of Business for several of their upper division courses. Success in these courses requires an understanding of descriptive and analytical approaches to problem solving.

D. MATH115 is an introductory course. Basic concepts of calculus and the mathematics of finance are introduced in this course for the purpose of developing analytical and quantitative skills which can be applied in upper level courses, particularly those related to business and economics. The first calculus course in the mathematics major sequence is MATH123, which is more rigorous than MATH123 and has a different emphasis. Besides mathematics majors, MATH123 is required of students in certain programs in the College of Natural Sciences and Mathematics. It is broader than MATH115 in that applications from a variety of fields are studied, and deeper since a thorough understanding of underlying concepts of calculus is emphasized.

Liberal Studies Office
110 Gordon Hall Ext. 7-5715

Dr. Mary E. Sadler
email: msadler

Date: December 7, 2000

To: Dr. Gerald Buriok

From: Dr. Mary E. Sadler

Subject: Liberal Studies approvals

The following proposals were reviewed and approved at the November 16, 2000 Liberal Studies committee meeting:

MATH 105 College Algebra – catalog description change approved.

MATH 115 Applied Mathematics for Business – new course approved for inclusion in Learning Skills – Mathematics category.

A copy of this memo is forwarded to the UWUCC so it is available as they review these proposals. Please don't hesitate to call if you have any questions about the review process.

CC: Dr. John Eck, Dean
UWUCC