SIMON FRASER UNIVERSITY

S.84-58

MEMORANDUM

To: SENATE

From: SENATE COMMITTEE ON UNDERGRADUATE STUDIES

Subject: NEW COURSE - MATHEMATICS AND STATISTICS

Date: OCTOBER 17, 1984

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of October 16, 1984 gives rise to the following motion:

MOTION: "That Senate approve and recommend approval to the Board of Governors, as set forth in S.84-58, the proposed new course

MATH 309-3 Continuous Optimization"

FOR INFORMATION

Acting under delegated authority at its meeting of October 16, 1984 the Senate Committee on Undergraduate Studies approved the following:

i) Change of course number MATH 194-3 to MATH 113-3
ii) Change of course number MATH 196-3 to MATH 213-3
iii) Change of prerequisites for MACM 216-3
iv) Change of prerequisites for MATH 404-3
v) Change in description MATH 151-3 and MATH 152
vi) Change in description and prerequisite for MATH 251-3 and MATH 252-3 and title of MATH 252-3
vii) Change in prerequisite for MATH 310-3
viii) Change of title, calendar description and prerequisites for MATH 313-3.

SIMON FRASER UNIVERSITY

MEMORANDUM

SCUS 84-21

To: W. Heath
Registrar

From: P. Dobud
Assistant to the Dean
Faculty of Science

Subject: CALENDAR CHANGES

Date: October 4, 1984

Please find attached the documentation relating to calendar changes approved in our Faculty of Science meeting held Monday, October 1, 1984.

I would appreciate it very much if you would place these items on the agenda of the next SCUS meeting for consideration and approval.

f) To approve the new course **MATH 309-3 Continuous Optimization.**

Theoretical and computational methods for investigating the minimum of a function of several real variables with and without inequality constraints. Applications to operations research, model fitting and economic theory.

Prerequisites: MATH 251 and 308.

Paper F-84-9

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

COURSE PROPOSAL FORM

1. **Calendar Information**

Department: Mathematics

Abbreviation Code: MATH Course Number: 309 Credit Hours: 3 Vector: 3-1-0

Title of Course: Continuous Optimization

Calendar Description of Course: Theoretical and computational methods for investigating the minimum of a function of several real variables with and without inequality constraints. Applications to operations research, model fitting, and economic theory.

Nature of Course

Prerequisites (or special instructions): MATH 251 and 308

What course (courses), if any, is being dropped from the calendar if this course is approved: none (The frequency of offering of MATH 313 will be reduced.)

2. **Scheduling**

How frequently will the course be offered? Once per year.

Semester in which the course will first be offered? Fall 1985

Which of your present faculty would be available to make the proposed offering possible: G. Bojadziev, R. Routledge, R. Russell, and others.

3. **Objectives of the Course**

To teach students computational and theoretical techniques for maximizing functions of continuous variables possibly subject to constraints, and to show how these techniques can be used in such fields as operations research, resource management, engineering, and mathematical economics.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty none

Staff none

Library a few books

Audio Visual none

Space none

Equipment none

5. **Approval**

Date: July 4 1984 OCT 02 1984

Department Chairman	Dean	Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

Course Description

Calendar Description: MATH 309-3 Continuous Optimization (3-1-0)

Theoretical and computational methods for investigating the minimum of a function of several real variables with and without inequality constraints. Applications to operations research, model fitting, and economic theory.

Prerequisites: MATH 251 and 308.

Detailed Description:

Unconstrained Optimization

Necessary and sufficient conditions for a minimum, with special reference to convex and concave functions.

Numerical techniques for functions of one variable.

Coordinate descent, steepest descent, and Newton's method for functions of several variables.

Introduction to conjugate direction and modified Newton's method.

Constrained Optimization

Review of duality in linear programming.

Necessary and sufficient conditions for a minimum of a function subject to constraints with special reference to convexity.

The Kuhn-Tucker conditions and their economic interpretation.

A survey of some computational methods.

Applications to operations research and model fitting.

Text: Introduction to Linear and Nonlinear Programming, by D.G. Luenberger, Addison-Wesley.

SIMON FRASER UNIVERSITY

MEMORANDUM

SCUS 84-20

To: W. Heath
Registrar

From: P. Dobud
Assistant to the Dean
Faculty of Science

Subject: CALENDAR CHANGES

Date: October 4, 1984

Please find attached the documentation relating to calendar changes approved in our Faculty of Science meeting held Monday, October 1, 1984.

I would appreciate it very much if you would place these items on the agenda of the next SCUS meeting for consideration and approval.

DEPARTMENT OF MATHEMATICS & STATISTICS

a) To approve the change of course number for the following courses:

From: MATH 194-3 Euclidean Geometry

To: MATH 113-3 Euclidean Geometry

and

From: MATH 196-3 Modern Geometry

To: Math 213-3 Modern Geometry

..../

b) To approve the change of prerequisites for MACM 216-3, Introduction to Computational Methods:

From: MATH 151 or 154 or 157 (formerly 150), CMPT 101 or 103 (except COBOL). Students who have obtained credit for MATH 104 may not receive credit for MACM 216.

Students who have taken the former MATH 216 or who have taken or who are taking MACM 316 (formerly MATH 316) may not take MACM 216 for further credit.

To: CMPT 101 or 102 or 103 (except COBOL); MATH 152 or 155 or 158 should precede or be taken concurrently.

Students who have obtained credit for MATH 104 may not receive credit for MACM 216.

Students who have taken the former MATH 216 or who have taken or are taking MACM 316 (formerly MATH 316) may not take MACM 216 for further credit.

Paper F-84-8

c) To approve the change of prerequisite for MATH 404-3 Statistical Design and Analysis of Experiments.

From: MATH 272 (or 371) or 302. Permission will be given to students from other Departments, with suitable backgrounds.

To: MATH 372 or 302. Permission will be given to students from other departments, with suitable backgrounds.

Paper F-84-8

d) To approve the change in description for MATH 151-3, Calculus I and MATH 152 Calculus II:

Calendar Description for MATH 151

From: Real number, functions and graphs, conic sections, limits and continuity, derivatives, techniques and application of differentiation, trigonometric functions, logarithms and exponentials, extrema, the mean value theorem.

..../

To: Real number, functions and graphs, conic sections, limits and continuity, derivatives, techniques and applications of differentiation, trigonometric functions, logarithms and exponentials, extrema, the mean value theorem, polar coordinates and complex numbers.

Calendar description for MATH 152

From: Integrals, techniques and applications of integration, approximations, sequences and series.

To: Integrals, techniques and applications of integration, approximations, sequences and series, area and arc length in polar coordinates.

Paper F-84-9

e) To approve the change in calendar description and prerequisite for MATH 251-3 and MATH 252-3 and the title of MATH 252-3.

From: **MATH 251-3 Calculus III**
Polar co-ordinates, vectors, solid analytic geometry, differential calculus of several variables, multiple integrals, line integrals, Complex numbers.

Prerequisites: MATH 152 or 155; or MATH 158 with a grade of A or B.

To: **MATH 251-3 Calculus III**
Vectors, solid analytic geometry, differential calculus of several variables, Lagrange multipliers, multiple integrals, cylindrical and spherical coordinates, line integrals.

Prerequisites: MATH 152 or 155; or MATH 158 with a grade of A or B. It is recommended that MATH 232 be completed before this course is attempted.

Paper F-84-9

From: **MATH 252-3 Vector Calculus I**

Differentials, Jacobians, transformation of multiple integrals, differentiation and integration of vector functions, integral theorems and their applications.

Prerequisites MATH 251 or 253.

It is recommended that MATH 232 precede or be taken concurrently. Students with credit for MATH 312 may not receive credit for MATH 252.

To: **MATH 252-3 Vector Calculus**

Vector functions of a single variable, space curves, scalar and vector fields, conservative fields, surface and volume integrals, and theorems of Gauss, Green and Stokes.

Prerequisites: MATH 232 and MATH 251 (or MATH 253). Students with credits for MATH 312 may not receive credits for MATH 252.

g) To approve the change in prerequisite for MATH 310-3.

From: MATH 152 or 155; or MATH 158 with a grade of A or B.

To: MATH 152 or 155; or MATH 158 with a grade of A or B. It is strongly recommended that MATH 232 be completed before this course is attempted.

Paper F-84-9

h) To approve the change on Title, Calendar description and prerequisites for MATH 313-3.

From: MATH 313-3 Vector Calculus II

Extrema of functions of several variables, Lagrange multipliers, curvilinear co-ordinates and vector differential calculus; space curves. Frente formulae; surfaces, curvature, Christoffel symbols.

Prerequisites: MATH 232 and 252 (or 253).

Students with credit for MATH 312 may not receive credit for MATH 313.

To: MATH 313-3 Differential Geometry

Curvature and torsion for space curves, Frenet formulae, tangents and normals to surfaces, curvatures of a surface, special points and curves on surfaces, calculus on surfaces.

Paper F-84-9

Prerequisites: MATH 232 and 252.

RATIONALE FOR PREREQUISITE CHANGES

MATH 404 (Statistical Design and Analysis of Experiments) formerly had as prerequisite one of MATH 272 or 302 or suitable background from another department. Students with no background in statistics beyond MATH 272 have been inadequately prepared for the material in MATH 404. For this reason, it is proposed that the 272 prerequisite be upgraded to MATH 372.

MACM 216 (Introduction to Computational Methods) contains a discussion of numerical integration. It seems logical to require one of MATH 152, 155, or 158 at least as a corequisite. The Computing Science department have been consulted, and have agreed to the proposal to upgrade the calculus prerequisite.

RATIONALE FOR CHANGES TO GEOMETRY COURSES

The material in MATH 196 (Modern Geometry) relies heavily on ideas in MATH 194 (Euclidean Geometry). Furthermore, the material has been judged by instructors and students to be substantially harder than that in most 100-level courses. Hence, it is proposed that MATH 196 be given a 200-level number, and that a course in Euclidean Geometry be made a prerequisite. We are also taking this opportunity to renumber these courses to emphasize the common geometric flavour of what we hope will become MATH 113, 213, and 313.

F-84-9

Brief Rationale for Course Proposals

Revisions to Calculus Sequence: Our existing calculus sequence has become out of step with most calculus sequences in North America. The problem, which has been particularly acute at the second-year level, has led to difficulties for transfer students and problems selecting appropriate textbooks. Following discussions with students, instructors, and faculty in departments whose students frequently take these courses, we believe that the proposed revisions will solve the above mentioned problem without unduly inconveniencing students or faculty involved in related programs. ~~In fact, we believe that the proposed revisions should substantially~~ benefit our major clients. At the request of the Chemistry Department, complex numbers will be treated in MATH 151 for the first time, and to better serve the needs of physicists, Green's theorem will now be treated in MATH 251.

MATH 313 and 309: The old syllabus for MATH 313 contained a mixture of material now included in MATH 251 and 252, continuous optimization, and differential geometry. We propose to provide a more solid treatment of these latter two topics by splitting the existing course into two courses. MATH 313 will become a bona fide course in differential geometry; MATH 309 will discuss continuous optimization. We are able to offer this new course by reducing the frequency of offering of MATH 313.

Prerequisite Statements Involving MATH 232: Instructors in MATH 251, 252, and 310 have repeatedly found that students in these courses can grasp the multidimensional concepts much more readily if they have taken or are taking linear algebra (MATH 232). We have resisted the temptation to add MATH 232 as a formal prerequisite for 251 and 310 because we realize that it would create difficulties for chemistry students. We nonetheless would like to formally advise students about the advantages of taking MATH 232.

Other Proposals not in this Package: Our department has also approved in principle a course in numerical linear algebra, but is not bringing it forth as a formal proposal at this time because we do not have the resources to mount it on a continuing basis. We would also like to offer courses in coding theory, applied algebra, and the theory of interest to enhance our programs to students with an interest in business and computing.