Applied Mathematics / Actuarial Science

APRC 1997-1998

section 1

Applied Mathematics / Actuarial Science:

Report of the Program Review Panel

September 15, 1997

Panel Members:

(1) John Hansen, Mathematics Department Chair

(2) Robert McCullough, Associate Professor of Mathematics, Chair of the PRP and Coordinator of the Applied Mathematics Program

(3) Walter Hoesksema, Professor of Biology

(4) Fred Wilson, Professor of Mathematics

(5) Karen Norman, Associate Professor College of Education

(6) Rick Neeley, New Business Development Director, Maritz and Advisory Board Member

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Section 1: Program Overview

The applied mathematics program and the actuarial science program are both four year programs leading to a bachelor of science degree. They are the only programs in the mathematics department leading to bachelor of science degree. The applied mathematics program has existed at Ferris State University for a number of years the actuarial science program is relatively new having existed since 1991. Both programs strive for excellence within the framework of the University, the College of Arts and Sciences, and the Department of Mathematics.

Actuarial Science

Actuaries are professionals trained in mathematics, statistics and economic techniques that allow them to put a financial value on future events. Questions typical of those answered by actuaries are: How many people aged 50 - 65 will have heart attacks in 2001 and what will their average claim be? How much money does a health insurance company need to set aside to pay for all the claims it will have in a given year? How much should homeowners pay for insurance? Actuaries can answer all those questions and any other risk-based questions by building and running mathematical models. This skill, is of great value to insurance companies, investment firms, employee benefits consulting firms, and other types of companies that need to quantify (put a price tag on) financial risks. Typically, it is with this type of firm that actuaries work. Actuarial science is a well paid profession. Entry level salaries fall between $32,000 and $45,000. For good candidates, signing bonuses are also common. Top actuaries with many years experience often earn over $100,000 a year. Many actuaries eventually leave the technical work behind and move into senior management of companies during the course of their careers. For example, many chief executives of insurance companies are actuaries. Actuaries must have undergraduate degrees and pass a series of examinations in order to work in the profession. There are two testing bodies in North America for actuaries, the Society of Actuaries which tests actuaries who work in the fields of life and health insurance, employee benefits, and investments and the Casualty Actuarial Society (CAS) which tests North American actuaries who work in the fields of property and casualty insurance. The actuarial science program provides students with the skills necessary to enter a career in actuarial science. A student completing the degree should be able to pass the first two actuarial exams which are administered jointly by the Society of Actuaries and the Casualty Actuarial Society.

Applied Mathematics

The applied mathematics program is designed to develop skills that are becoming increasingly valued by employers. While many applied math majors go on to graduate study in fields like statistics, mathematics or industrial management, others are entering the work force in a variety of areas. An applied math background is helpful in any job where problem-solving skills are required. Students in the applied mathematics program emphasizes both the theoretical background necessary to work in mathematics and practical applications. In addition to a number of applied mathematics and computer science courses they are required to take twenty credits in an application area. Graduates of the applied mathematics program most commonly find employment as either computer scientists or statisticians.

Section 2 to 9 Overview

The Program Review Panel carried out several different activities to evaluate the quality of the applied mathematics and actuarial science programs. This section gives a brief summary of how data was collected.

2. **Advisory Board perceptions:** A survey was distributed to members of the applied mathematics and actuarial science advisory board. The entire board responded.

3. **Perceptions of Graduates:** Graduates of the program responded to a survey.

4. **Perceptions of the Mathematics Department:** Since the actuarial science and applied mathematics programs are housed in the mathematics department we determined the departments perceptions of the strengths and weaknesses of the program. The mathematics department was surveyed.

5. **Employer Perceptions:** Employers and potential employers were surveyed.

6. **Labor Market Analysis:** Based on labor department statistics.

7. **Perceptions of Students:** Students currently enrolled in the program were surveyed.

8. **Evaluation of Facilities and Equipment:** A review of classroom computer display equipment, student laboratories, hardware and software.

9. **Curriculum Evaluation:** Bases on required class information, and comparison of programs with other Michigan schools.

Section 2
Advisory Board Perceptions

The applied mathematics and actuarial science advisory board was issued a questionnaire. The questionnaire consisted of twelve questions and an invitation to write comments. The next page is a blank questionnaire and the following page contains a summary.

Advisory Board Survey

Answer each question as follows:

5: strongly agree
4: agree
3: no opinion
2: disagree
1: strongly disagree

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University.
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods.
3. Opportunities are provided for related work and/or internship experiences.
4. Ferris has an effective system for locating jobs and placing students in these programs.
5. Adequate funds are provided by the University to support the achievement of program objectives.
6. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs.
7. The coordinators do an effective job in advising students.
8. Current data on labor market trends are systematically used in evaluating and modifying these programs.
9. Computer hardware is adequate for the needs of the programs.
10. Computer software is adequate for the needs of the programs.
11. The academic rigor of the required courses in the program adequately prepare students for the job market.
12. Graduate follow-up studies are used to assess and modify the programs.

Write any comments you might have on the programs.

Advisory Board Survey Summary

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University. **(5.0)**
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods. **(3.67)**
3. Opportunities are provided for related work and/or internship experiences. **(3.33)**
4. Ferris has an effective system for locating jobs and placing students in these programs. **(4.67)**
5. Adequate funds are provided by the University to support the achievement of program objectives. **(4.0)**
6. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs. **(4.67)**
7. The coordinators do an effective job in advising students. **(4.0)**
8. Current data on labor market trends are systematically used in evaluating and modifying these programs. **(4.33)**
9. Computer hardware is adequate for the needs of the programs. **(4.0)**
10. Computer software is adequate for the needs of the programs. **(3.67)**
11. The academic rigor of the required courses in the program adequately prepare students for the job market. **(5.0)**
12. Graduate follow-up studies are used to assess and modify the programs. **(4.0)**

Comments:

1. Your students have an excellent grasp of theoretical statistics they could use a course on experimental design and sampling theory.
2. You need a way to differentiate between students who are basically statisticians and those who are basically computer scientists. (I realize looking at the course work will show this but it would be better if this was conveyed by the name of the degree.)
3. You need an advanced data structures course.
4. You need to produce more students we could use them.

Section 3
Perceptions of Graduates

Applied mathematics and actuarial science graduates were surveyed. The questionnaire consisted of ten questions and an invitation to write comments. The next page is a blank questionnaire and the following page contains a summary.

Graduate Survey

Answer each question as follows:

5: strongly agree
4: agree
3: no opinion
2: disagree
1: strongly disagree

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University.
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods.
3. Opportunities are provided for related work and/or internship experiences.
4. Ferris has an effective system for locating jobs and placing students in these programs.
5. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs.
6. The coordinators do an effective job in advising students.
7. Current data on labor market trends are systematically used in evaluating and modifying these programs.
8. Computer hardware is adequate for the needs of the programs.
9. Computer software is adequate for the needs of the programs.
10. The academic rigor of the required courses in the program adequately prepare students for the job market.

Write any comments you might have on the programs.

Graduate Survey Summary

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University. **(4.67)**
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods. **(4.0)**
3. Opportunities are provided for related work and/or internship experiences.**(3.33)**
4. Ferris has an effective system for locating jobs and placing students in these programs. **(4.67)**
5. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs. **(4.33)**
6. The coordinators do an effective job in advising students. **(5.0)**
7. Current data on labor market trends are systematically used in evaluating and modifying these programs. **(4.0)**
8. Computer hardware is adequate for the needs of the programs. **(4.0)**
9. Computer software is adequate for the needs of the programs. **(3.67)**
10. The academic rigor of the required courses in the program adequately prepare students for the job market. **(4.33)**

Write any comments you might have on the programs.

1. A good education.
2. Everyone was helpful.
3. Instruction was better than MSU.
4. I received a number of job offers.
5. The friendliest department on campus.

Section 4
Perceptions of the Mathematics Department

Members of the mathematics department were surveyed. The questionnaire consisted of twelve questions and an invitation to write comments. The next page is a blank questionnaire and the following page contains a summary.

Faculty Survey

Answer each question as follows:

5: strongly agree
4: agree
3: no opinion
2: disagree
1: strongly disagree

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University.
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods.
3. Opportunities are provided for related work and/or internship experiences.
4. Ferris has an effective system for locating jobs and placing students in these programs.
5. Adequate funds are provided by the University to support the achievement of program objectives.
6. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs.
7. The coordinators do an effective job in advising students.
8. Current data on labor market trends are systematically used in evaluating and modifying these programs.
9. Computer hardware is adequate for the needs of the programs.
10. Computer software is adequate for the needs of the programs.
11. The academic rigor of the required courses in the program adequately prepare students for the job market.
12. Graduate follow-up studies are used to assess and modify the programs.

Write any comments you might have on the programs.

Faculty Survey Summary

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University. **(4.6)**
2. Instruction in all required courses responds to individual student learning styles and abilities through using a variety of instructional methods.**(3.27)**
3. Opportunities are provided for related work and/or internship experiences.**(2.93)**
4. Ferris has an effective system for locating jobs and placing students in these programs.**(3.47)**
5. Adequate funds are provided by the University to support the achievement of program objectives.**(2.47)**
6. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs.**(4.13)**
7. The coordinators do an effective job in advising students.**(4.2)**
8. Current data on labor market trends are systematically used in evaluating and modifying these programs.**(3.6)**
9. Computer hardware is adequate for the needs of the programs.**(4.13)**
10. Computer software is adequate for the needs of the programs. **(3.73)**
11. The academic rigor of the required courses in the program adequately prepare students for the job market.**(4.2)**
12. Graduate follow-up studies are used to assess and modify the programs.**(3.27)**

Comments:

1. No program anywhere can respond to individual student learning styles and abilities while maintaining the integrity of the program. Students must be able to respond to the market (not the market to the student.).
2. 3,4, and 5 are the key to a successful program.
3. This is not a bad thing.*(Referring to a low score on 2.)*
4. Small classes are not routinely allowed.*(Referring to a low score on 5.)*
5. Informally. *(Referring to 8 and 12.)*
6. On average, but not uniformly.*(Referring to 12.)*
7. Regarding Question 3, even though the answer is 4-agree, more exploration should be done in acquiring internship availability.
8. I don't teach these students so my responses are to be taken lightly.
9. Classes should be allowed to go with low enrollments.

Section 5
Employer Perceptions

Employers and potential employers were surveyed. The questionnaire consisted of five questions and an invitation to write comments. The next page is a blank questionnaire and the following page contains a summary.

Employer Survey

Answer each question as follows:
5: strongly agree
4: agree
3: no opinion
2: disagree
1: strongly disagree

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University.
2. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs.
3. The coordinators do an effective job in advising students.
4. Current data on labor market trends are systematically used in evaluating and modifying these programs.
5. The academic rigor of the required courses in the program adequately prepare students for the job market.

Write any comments you might have on the programs.

Employer Survey

1. The Applied Mathematics / Actuarial Science programs are in line with the mission of Ferris State University. **(4.75)**
2. The program coordinators are well-versed in the requirements of the job market and aid the department in the formulation of new objectives for courses and programs. **(4.5)**
3. The coordinators do an effective job in advising students. **(4.25)**
4. Current data on labor market trends are systematically used in evaluating and modifying these programs. **(4.0)**
5. The academic rigor of the required courses in the program adequately prepare students for the job market. **(4.75)**

Comments:

Section 6
Labor Market Analysis

The following tables are taken from a survey by the NSF of recent college graduates who were employed in non-academic positions. The 1993 National Survey of Recent College Graduates sponsored by the NSF provides a look at demographic, educational and employment characteristics of recent bachelor's and master's degree recipients. The survey includes data on degree recipients who graduated during spring 1990, academic year 1990-1991, and academic year 1991- 1992. A sample of 25,785 graduates (16,585 bachelor's and 9,200 master's) were selected and the unweighted response rate was 85.7 percent. Of those who responded, 673 had received bachelor's degrees in the mathematical sciences and 391 had received master's degrees in the mathematical sciences. Participants were asked questions about their education background and their present employment status. They were also asked information about their work day activities and salary. This is a summary of the data focusing on the types of nonacademic positions recent graduates are obtaining and the duties they perform. We have only listed bachelor's degree information.
A note on the data:
The NSF counts students employed by a university as a graduate or research assistant within the employment area that comes closest to their field. So a graduate assistant working on statistical applications is counted under the job code for Statistics. However, for the purposes of this summary, graduates who are full or part-time students working as graduate or research assistants are counted as academically employed. They were identified by their employer, salary (under 15,000), and by the description they gave of their position. A graduate student who is a teaching assistant teaching in mathematics would be listed under Postsecondary Education, Mathematics in the NSF data and for this study would also be counted as academically employed.

Participants were asked questions about their education background and their present employment status. In particular, each bachelor's degree recipient was asked about their major area of study. Those who majored in the mathematical sciences were asked to choose from four major areas of study. Table 1 displays the result for bachelor's graduates in the mathematical sciences.

Table 1: % of Bachelor's Degree Recipients by Major Area of Study in the Mathematics Sciences

Major Area of Study	Percent of Bachelor's Recipients
General Mathematics	82
Applied Mathematics	8
Statistics	4
Operation Research	1
Other	5

Table 2 displays the percent of bachelor's degree recipients with a major in the mathematical sciences by sector of employment. The academic sector includes the following: teachers in primary or secondary education; educators in post secondary positions; and graduate students working as teaching assistants or graduate assistants. Graduates who are not full time students or graduate research assistants but are employed by academic institutions in non-teaching positions are considered employed in a nonacademic position.

Table 2: % of Bachelor's Degree Recipients with a Major in the Mathematical Sciences by Employment Sector

Employment Sector	Percent of Bachelor's Recipients
Nonacademic	58
Academic	29
Student, Not Employed	7
Other Unemployed	5

Each employed participant was asked to identify their occupation by choosing a job code which best identified their principle occupation. Table 3 displays the percent of bachelor's graduates in nonacademic occupations by occupation area. Respondents classified as Management and Related Positions describe a range of positions, including management of programs or projects, personnel management and management consultants. Those classified as Other show an even greater range of positions, including technical writer, law clerk, landscaper, bartender, casino dealer, and pilot.

Table 3: % of Bachelor's Degree Recipients with a Major in the Mathematical Sciences Working in a Nonacademic Position by Occupation

Occupation	Percent of Bachelor's Recipients
Accounting and Finance	14
Computer Programming	14
Sales and Marketing	10
Management and Related Positions	8
Actuarial	6
Computer Systems Analysis	5
Engineering	4
Statistics	3
Mathematics, OR, Modeling	2
Other Computer Science	6
Other Sciences, Health, and Social Services	3
Other Technical Areas	2
Other Occupations	23

Participants were asked to identify the type of company or institution that employed them. Table 4 displays the result or responses given by bachelor's degree recipients with a major in the mathematical sciences working in a nonacademic position. Recall that the positions at education institutions are non-teaching positions, such as positions in the business office.

Table 4: % of Bachelor's Degree Recipients with a Major in the Mathematical Sciences in a Nonacademic Position by Type of Employer

Type of Employer	Percent of Bachelor's Recipients
Private for Profit	77
Private, Not for Profit	3
Self Employed	3
Education Institution	7
Federal Government - Civilian	3
Federal Government - Military	3
State or Local Government	4

Participants were asked to list the top two activities they spend the most hours working at during a typical week. Table 5 shows the response of bachelor's degree recipients with a major in the mathematical sciences in a nonacademic position to being asked on which activity they spent the most hours and Table 6 displays their response to being asked on which activity they spent the second most number of hours. Table 5 shows that 32% of the respondents spent the most number of their work hours on computer applications. Table 6 shows that 16% of the respondents choose computer applications as the activity with the second most number of hours and 18% choose no second activity.

Table 5: % of Bachelor's Degree Recipients With a Major in the Mathematical Sciences in a Nonacademic Position Selecting an Activity They Spend the Most Hours Working on During a Typical Work Week

Activity	Percent of Bachelor's Recipients
Computer Applications	32
Accounting, Finance, Contracts	11
Management and Administration	8
Professional Services	8
Sales, Purchasing, Marketing	7
Applied Research	5
Quality or Productivity Management	5
Development	4
Basic Research	3
Employee Relations	3
Production, Operations, Maintenance	3
Teaching	2

Design Equipment, Processes, Structure	1
Other	8

Table 6: % of Bachelor's Degree Recipients With a Major in the Mathematical Sciences in a Nonacademic Position Selecting an Activity They Spend the Second Most Number of Hours Working on During a Typical Work Week

Activity	Percent of Bachelor's Recipients
Computer Applications	16
Applied Research	10
Quality or Productivity Management	9
Accounting, Finance, Contracts	8
Management and Administration	8
Development	6
Employee Relations	6
Basic Research	4
Professional Services	4
Sales, Purchasing, Marketing	4
Design Equipment, Processes, Structure	3
Teaching	2
Production, Operations, Maintenance	1
Other	1
Inapplicable (No Answer)	18

Participants were asked for their salary, before deductions, and not including bonuses, overtime or additional compensation. Table 7 displays this data for bachelor's degree recipients with a major in the mathematical sciences working in a nonacademic position. These are graduates employed full time and does not include those who are self-employed (part-time or full-time).

Table 7: % of Bachelor's Degree Recipients With a Major in the Mathematical Sciences in a Nonacademic Position by Full Time Salary Range

Salary Range	Percent of Bachelor's Recipients
Less Than $10,000	1
$10,000 - $19,999	23
$20,000 - $29,999	34
$30,000 - $39,000	30
$40,000 - $49,999	9
$50,000 - $59,999	2

Section 7
Perceptions of Students

Students were surveyed. The questionnaire consisted of seven questions and an invitation to write comments. The next page is a blank questionnaire and the following page contains a summary.

Student Survey

Answer each question as follows:
5: strongly agree
4: agree
3: no opinion
2: disagree
1: strongly disagree

1. Instruction in the required courses responds to individual student learning styles and abilities through using a variety of instructional methods.
2. Opportunities are provided for related work and/or internship experiences.
3. The coordinators do an effective job in advising students.
4. Computer hardware is adequate for the needs of the programs.
5. Computer software is adequate for the needs of the programs.
6. The academic rigor of the required courses in the program adequately prepare students for the job market.
7. I am satisfied with instruction in the program.

Write any comments you may have on the program.

Student Survey Summary

1. Instruction in the required courses responds to individual student learning styles and abilities through using a variety of instructional methods. **(3.67)**
2. Opportunities are provided for related work and/or internship experiences.**(2.67)**
3. The coordinators do an effective job in advising students.**(4.33)**
4. Computer hardware is adequate for the needs of the programs.**(3.33)**
5. Computer software is adequate for the needs of the programs.**(2.67)**
6. The academic rigor of the required courses in the program adequately prepare students for the job market.**(4.33)**
7. I am satisfied with instruction in the program. **(4.67)**

Write any comments you may have on the program.

1. There should be more courses to choose from.

Section 8
Evaluation of Facilities and Equipment

Rooms and Hardware

There are presently three classrooms equipped with a computer and large screen display. These classrooms are used for computer science courses and for courses in which Derive (a symbolic algebra system) is used. As more and more mathematics classes move toward using derive we will most likely need more such rooms. At present this is an adequate number of such rooms.

The main computing facility used by the students is located in ASC 1015. It consists of fifty Pentium workstations. This more than adequate for present usage. In addition faculty sometimes bring students to the Computer seminar room in ASC 1008 or the small computer seminar room in STR 109. The computer seminar room in ASC 1008 has thirty-five Pentium workstations and large screen projection. The small computer seminar room in STR 109 has twenty Pentium workstations and large screen display.

Software

Computer Science Courses:

The department currently teaches CPSC 205 and CPSC 215 in Pascal. The current Pascal compiler has an expired licensee this means we are allowed to use it but cannot reinstall it on the network. The department is thinking about changing the language for these courses. Whether or not we change languages a new compiler should be decided on within the next two years. We have a similar problem with the assembler used in CPSC 310 and with the FORTRAN compiler used in CPSC 244. There is also a need to change to Visual Basic from Quick Basic in CPSC 150.

Mathematics Courses:

On the mathematics side we have just upgraded our computer algebra system to Derive for windows and the upgrade seems to be working well. Derive is currently required in MATH 220 Analytic Geometry and Calculus 1 and in MATH 230 Analytic Geometry and Calculus 2. It is also sometimes used in higher level courses such as MATH 320 Analytic Geometry and Calculus 3 and MATH 330 Differential Equations. It is also used in two courses that are not part of either

program MATH 216 Applied Calculus and Math 226 Fourier Series and Applied Differential Equations.

Statistics Courses:

Currently SPSS is available for use in our statistics courses. Some people think SAS would be a much better choice for our students. SPSS is sufficient for our current level of involvement.

Section 9
Curriculum Evaluation

Successful graduates of the Actuarial Science program are equipped with the skills necessary to start an actuarial career. The actuarial science program does a good job of equipping students with these skills. For those students choosing not to become actuaries the program ensures sufficient background in statistics and computer science so they can find employment. This is ensured by our advisory board and by our continued monitoring of professional guidelines and examinations. The applied mathematics program ensures that its graduates will have a strong back ground in mathematics that is applicable in business or industry. The applied mathematics program also does an excellent job of preparing students for graduate studies in mathematics, statistics, or computer science.

High-level mathematics courses are shared between the actuarial science program, the applied mathematics program and the mathematics education program. All of the mathematics courses in the actuarial science program are either required or valid electives in the applied mathematics program with the exception of MATH 250, MATH 385, and MATH 485. All of the mathematics courses in the actuarial science program are also either required or elective courses in the mathematics education program. This makes for a rather interesting synergy between the programs.

Required mathematics and computer science courses in the actuarial science program:
CPSC 205
CPSC 215
MATH 220
MATH 230
MATH 250
MATH 314
MATH 320
MATH 322
MATH 328
MATH 340
MATH 360
MATH 385
MATH 414
MATH 416
MATH 485

Required mathematics and computer science courses in the applied mathematics program:
CPSC 205

CPSC 215
MATH 220
MATH 230
MATH 320
MATH 322
MATH 328
MATH 340
MATH 360
MATH 380
MATH 414
MATH 440

Elective mathematics and computer science courses in the applied mathematics program:

CPSC 310
CPSC 320
CPSC 326
CPSC 328
CPSC 350
CPSC 442
MATH 314
MATH 324
MATH 325
MATH 416
MATH 420
MATH 430

Required mathematics and computer science courses in the mathematics education program:
CPSC 205 or CPSC 244
MATH 220
MATH 230
MATH 314
MATH 320
MATH 322
MATH 324
MATH 325
Elective mathematics courses in the mathematics education program:
9 credits of mathematics electives.

The next pages contain the syllabi for all mathematics and computer science courses in both programs.

MATH 220 **CALCULUS AND ANALYTIC GEOMETRY I**

Topics include: the limit, continuity, the derivative, differentiation of algebraic and transcendental functions with applications, implicit differentiation, and introduction to integration with applications.

TEXT: Calculus, 5th Edition, Larson, Hostetler, and Edwards, Heath Publishing Company.

PREREQUISITE: MATH 130 with a grade of C- or better or its equivalent

Sections	Topic	Approx hrs
i-1 - i-6	Algebraic and Trigonometric Functions (Introduce DERIVE - Lab)	5
1.1 - 1.5	Limits and Their Properties (Omit formal definition of the limit)	6
2.1 - 2.6	Differentiation	14
3.1 - 3.7 3.9	Applications of Differentiation Differentials (Omit 3.8 and 3.10)	14
4.1 - 4.5 4.6	Integration Trapezoidal rule only	10
5.1 - 5.6	Logarithmic and Exponential Functions (Omit 5.7, 5.8, and 5.9)	10
	Review, Quizzes, and Exams	10
	Final Exam	2

MATH 230 CALCULUS AND ANALYTIC GEOMETRY II (5 Sem. Hrs.)

Applications of integration, inverse trigonometric functions, techniques of integration, indeterminate forms, numerical methods and approximation, infinite series, conics and polar coordinates, vector-valued functions and curvilinear motion.

TEXT: CALCULUS, 5th Edition, Larson, Hostetler, and Edwards, Heath Publ.

PREREQUISITE: MATH 220 with a grade of C- or better or its equivalent

Sections	Topic
5.7, 5.8	Inverse Trig Functions.
6.1- 6.7	Applications of Integration
7.1 - 7.8	Integeration Methods, L'Hopitals Rule, Improper integrals
8.1 - 8.10	Sequences and Series, Polynomial Approximation
9.1 - 9.3	Basic Conic Sections
10. 1 - 10.4	Parametric Equations and Polar Coordinates

MATH 250 STATISTICS FOR THE LIFE SCIENCES **2 credit hours** **(F.Wilson, Fall, 1994)**

Application of statistical methods to describing data and making decisions from data in the life sciences. Topics include: frequency distributions, central tendency, dispersion, probability, probability distributions, statistical inference, hypothesis testing, regression and correlation, and analysis of variance.

PREREQUISITE: Grade of C- or higher in MATH 130 (old MTH 125) or equivalent

TEXT: Statistical Methods in the Biological and Health Sciences, Milton, 2nd edition, McGraw-Hill

CONTENT

Chapter 1	DESCRIPTIVE METHODS
1.1	Distribution Tables: Discrete Data
1.2	A Quick Look at Distribution: Stem and Leaf
1.3	Frequency Distributions: Histograms, Cumulative Distribution
1.4	Measures of Location
1.5	Measures of Variability
Chapter 2	INTRODUCTION TO PROBABILITY AND COUNTING
2.1	Interpreting Probabilities
2.2	Tree Diagrams and Elementary Genetics
2.3	Permutations and Combinations
2.4	Multiplication Principle
2.5	Permutations of Indistinguishable Objects
Chapter 3	PROBABILITY AND PROBLEM SOLVING
3.1	Venn Diagrams and the Axioms of Probability
3.2	General Addition Rule
3.3	Conditional Probability
3.4	Diagnostic Tests and Relative Risk
3.5	Independence
3.6	The Multiplication Rule
3.7	Bayes' Theorem
Chapter 4	DISCRETE RANDOM VARIABLES
4.1	Discrete and Continuous Variables
4.2	Discrete Density Functions and Expectation
4.3	Cumulative Distribution Function
4.4	Binomial Distribution
Chapter 5	CONTINUOUS RANDOM VARIABLES
5.1	Continuous Density Functions and Expectation
5.2	Cumulative Distribution Function
5.3	Normal Distribution
Chapter 6	INFERENCES ON THE MEAN
6.1	Random Sample and Randomization
6.2	Point Estimation of the Mean
6.3	Rules for Expectation and Variance (Optional)
6.4	Introduction to Interval Estimation
6.5	Confidence Interval on the Population Mean and the T Distribution
6.6	Introduction to Hypothesis Testing
Chapter 8	INFERENCES ON PROPORTIONS
8.1	Point Estimation
8.2	Interval Estimation of p
8.3	Sample Size for Estimating p
8.4	Hypothesis Testing on p
8.5	Comparing Two Proportions: Estimation
8.6	Comparing Two Proportions: Hypothesis Testing
Chapter 9	COMPARING TWO MEANS
9.1	Point Estimation: Independent Samples
9.3	Inferences on $\mu_1 - \mu_2$: Pooled T
9.4	Inferences on $\mu_1 - \mu_2$: Unequal Variances
9.5	Inferences on $\mu_1 - \mu_2$: Paired T

MATHEMATICS COURSE CONTENT

MATH 314 PROBABILITY 3 Credits
Discrete probability theory, including: Combinatorial analysis, properties of probability, conditional probability, random variables, expectation, and limit theorems.
Prerequisite: MATH 220
Text: Probablity, An Introduction, Samuel Goldberg, 1960, Dover Publications

CONTENT

CHAPTER	TOPIC
1. SETS	1. Examples of sets; basic notation, 1 2. Subsets, 8 3. Operations on sets, 16 4. The algebra of sets, 28 5. Cartesian product sets, 39
2. PROBABILITY IN FINITE SAMPLES SPACES	1. Sample spaces, 45 2. Events, 51 3. The probability of an event, 54 4. Some probability theorems, 64 5. Conditional probability and compound experiments, 74 6. Bayes' formula, 91 7. Independent events, 102 8. Independence of several events, 107 9. Indepenent trials, 113 10. A probability model in genetics, 123
3. SOPHISTICATED COUNTING	1. Counting techniques and probability problems, 132 2. Binomial coefficients, 149
4. RANDOM VARIABLES	1. Random variables and probability functions, 158 2. The mean of a random variable, 172 3. The variance and standard deviation of a random variable, 185 4. Joint probability functions; independent random variables, 197 5. Mean and variance of sums of random variables; the sample mean, 212 6. Covariance and correlation; sample mean (cont.) 232
5. BINOMIAL DISTRIBUTION AND SOME APPLICATIONS	1. Bernoulli trials and the binomial distribution, 252 2. Testing a statistical hypothesis, 272 3. An example of decision-making under uncertainty, 286

MATH 320 ANALYTICAL GEOMETRY AND CALCULUS III 3 credits

The fourth of a three-semester sequence in analytic geometry and calculus. Topics include: vector valued functions, functions of several variables, and multiple integrals.

PREREQUISITE: MATH 230

TEXT: Calculus With Analytical Geometry, 6th Ed., Dale Varberg & Edwin Purcell, Prentice Hall Publisher.

CONTENT

CHAPTER/SECTION	TOPIC
14	**GEOMETRY IN SPACE, VECTORS**
14.1	Cartesian Coordinates in Three-Space
14.2	Vectors in Three-Space
14.3	The Cross Product
14.4	Lines and Curves in Three-Space
14.5	Velocity, Acceleration, and Curvature
14.6	Surfaces in Three-Space
14.7	Cylindrical and Spherical Coordinates
15	**THE DERIVATIVE IN *n*-SPACE**
15.1	Functions of Two or More Variables
15.2	Partial Derivatives
15.3	Limits and Continuity
15.4	Differentiability
15.5	Directional Derivatives and Gradients
15.6	The Chain Rule
15.7	Tangent Planes, Approximations
15.8	Maxima and Minima
16	**THE INTEGRAL IN *n*-SPACE**
16.1	Double Integrals over Rectangles
16.2	Iterated Integrals
16.3	Double Integrals over Nonrectangular Regions
16.4	Double Integrals in Polar Coordinates
16.5	Applications of Double Integrals
16.6	Surface Area
16.7	Triple Integrals (Cartesian Coordinates)
16.8	Triple Integrals (Cylindrical and Spherical Coordinates)
17	**VECTOR CALCULUS**
17.1	Vector Fields
17.2	Line Integrals
17.3	Independence of Path
17.4	Green's Theorem in the Plane
17.5	Surface Integrals
17.6	Gauss's Divergence Theorem

MATH 322 LINEAR ALGEBRA

An introduction to the theory of vector spaces with emphasis on matrix algebra. Topics included are linear transformation, independence, rank, and inverses. (3 + 0)

PREREQUISITE: MATH 220

TEXT: Introductory Linear Algebra with Applications, 6th Edition, Kolman
Macmillan Publishing Company

CONTENT

CHAPTER/SECTION TOPIC

Chapter 1 Linear Equations and Matrices
- 1.1 Linear Systems
- 1.2 Matrices
- 1.3 Dot Product and Matrix Multiplication
- 1.4 Properties of Matrix Operations
- 1.5 Solutions of Equations
- 1.6 The Inverse of a Matrix

Chapter 2 Determinants
- 2.1 Definition and Properties
- 2.2 Cofactor Expansion and Applications
- 2.3 Determinants from a Computational Point of View

Chapter 3 Vectors and Vector Spaces
- 3.1 (Optional) Vectors in the Plane
- 3.2 n - vectors
- 3.3 Introduction to Linear Transformations
- 3.4 (Optional) Computer Graphics
- 3.5 Cross Products in R^3
- 3.6 Lines and Plains

Chapter 4 Linear Transformations and Matrices
- 4.1 Real Vector Spaces
- 4.2 Subspaces
- 4.3 Linear Independence
- 4.4 Basis and Dimension
- 4.5 Homogenous Systems
- 4.6 The Rank of a Matrix and Applications
- 4.7 Coordinates and Change of Basis
- 4.8 (Optional) Orthonormal Bases in R^N

Chapter 5 (Optional) Eigen Values and Eigen Vectors
- 5.1 Diagonalization
- 5.2 Diagonalization of Symmetric Matrices

MATHEMATICS COURSE CONTENT

FALL 1993
J. LINNEN

MATH 324 FUNDAMENTALS CONCEPTS IN MATHEMATICS 3 CREDITS

An introduction to mathematical structure and deductive logic thru the study of fundamental systems. Topics include logic, sets, relations and functions. The fundamental methods of mathematical proofs are emphasized throughout the course.

PREREQUISITE: One term of calculus.

TEXT: A Transition to Advanced Mathematics; Smith, Eggen, and St. Andre; Third Edition; Brooks/Cole.

CONTENT

Chapter/Section

Chapter 1 Logic and Proofs
- 1.1 Proposition and Connectives
- 1.2 Conditionals and Biconditionals
- 1.3 Quantifiers
- 1.4 Mathematical proofs
- 1.5 Proofs involving quantifiers
- 1.6 Additional examples of proofs

Chapter 2 Set Theory
- 2.1 Basic notions of set theory
- 2.2 Set Operations
- 2.4 Mathematical induction

Chapter 3 Relatations
- 3.1 Cartesian Products and Relations
- 3.2 Equivalence Relations

Chapter 4 Functions
- 4.1 Functions as Relations

Chapter 6 Concepts of Algebra
- 6.1 Algebraic Structures

M. Dargitz
Fall, 1993

MATHEMATICS COURSE CONTENT

MATH 325 COLLEGE GEOMETRY 3 CREDITS

This course's primary function is to prepare a student to teach high school geometry.

TEXT: Roads to Geometry, Wallace and West, Prentice Hall Publishing Co.

PREREQUISITE: MATH 230 or consent of instructor.

CONTENT

The course content will consist of related topics in the first 5 chapters. Some supplementary topics will be added as deemed necessary to ensure that the students will be able to handle the teaching of the first year of high school geometry. If there are questions please contact Mr. Dargitz or Ms. Allegretto.

G. Lobo
Fall, 1993

MATHEMATICS COURSE CONTENT

MATH 330 DIFFERENTIAL EQUATIONS **3 Credits**

Ordinary linear differential equations and classical solutions to special types of non-linear equations. Series solutions, systems of linear differential equations and numerous applications of differential equations.
PREREQUISITE: MATH 330 or EQUIVALENT or CONSENT OF INSTRUCTOR.
TEXT: DIFFERENTIAL EQUATIONS - A Modeling Approach, Frank R. Giordano & Maurice D. Weir, Addison-Wesley Publishing Company.

CONTENT

Chapter 1 DIFFERENTIAL EQUATIONS AND MODELS
- 1.1 Solutions and Initial Value Problems.
- 1.2 An Overview of Modeling.
- 1.3 Modeling with first order ODE.
  -There are four models. Try to do at least two.
- 1.4 Graphing Solutions to first order ODE.

Chapter 2 FIRST - ORDER DIFFERENTIAL EQUATIONS
- 2.1 Separation of Variables.
- 2.2 Linear Equations.
- 2.3 Exact Equations.

Chapter 3 HOMOGENEOUS LINEAR EQUATIONS (with constant coefficients)
- 3.1 Modeling with Linear Differential Equations.
- 3.2 Second Order Equations - Basic Theory.
- 3.3 Constant Coefficient Homogeneous Linear Equations.
- 3.4 Applications - Can use any of the models in this section or use a model of your own choice.
- 3.5 Linear Higher Order Equations.

Chapter 4 NON HOMOGENEOUS LINEAR EQUATIONS
- 4.1 Solutions to non homogeneous linear equatiens.
- 4.2 Method of Undetermined coefficients.
- 4.4 Variation of parameters. (May go over 4.3 if needed)
- 4.5 Applications - Can use the model in this section or use a model of your own choice.

Chapter 7 SYSTEMS OF FIRST ORDER DIFFERENTIAL EQUATIONS
- 7.1 Modeling with more than one dependent variable.
- 7.2 Solutions to Systems of Differential Equations.
  -Problems 11 - 44 cannot be done with material in the section.
- 7.3 Homogeneous 2x2 linear systems with constant coefficients.
- 7.4 Distinct Eigenvalues.
- 7.5 Repeated Eigenvalues.
- 7.6-7.8 Applications - Can use the models in these sections or use a model of your own choice. Do as many as time permits.

Chapter 9 LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS
- 9.1 Power Series Solutions.
- 9.2 Frobenius Series.

OPTIONAL: Any of the following sections can be covered if time permits.
2.5, 2.7, 2.8, 2.9, 8.1, 8.2, 8.3, 9.5, 9.6

Fall, 1993
V. Konecny

MATHEMATICS COURSE CONTENT

MATH 340 NUMERICAL ANALYSIS 3 Credits

Numerical algorithms for root finding, interpolation, integration, linear algebra, and differential equations.

Prerequisite: CPSC 215 and at least a corequisite of MATH 320.

Text: Numerical Mathematics and Computing, by Cheney and Kincaid, Brooks/Cole Publishing, 2nd edition.

CONTENT

CHAPTER/SECTION	SUGGESTED TOPIC
Chapter 1	INTRODUCTION
1.1	Programing Suggestions
1.2	Review of Taylor Series
Chapter 2	NUMBER REPRESENTATIONS AND ERRORS
2.1	Representation of Numbers in Different Bases
2.2	Floating-Point Number System
2.3	Loss of Significance
Chapter 3	LOCATING ROOTS OF EQUATIONS
3.1	Bisection Method
3.2	Newton's Method
Chapter 4	INTERPOLATION AND NUMERICAL DIFFERENTIATION
4.1	Polynomial Interpolation
4.2	Errors in Polynomial Interpolation
4.3	Estimating Derivatives
Chapter 5	NUMERICAL INTEGRATION
5.1	Definite Integral
5.2	Trapezoid Rule
5.3	Romberg Algorithm
Chapter 6	SYSTEMS OF LINEAR EQUATIONS
6.1	Naive Gaussian Elimination
6.2	Gaussian Elimination with Scaled Partial Pivoting
6.3	Tridiagonal and Other Band Systems
Chapter 7	APPROXIMATIONS BY SPLINE FUNCTIONS, 7.1 AND 7.2
OR	
Chapter 10	SMOOTHING OF DATA AND THE METHOD OF LEAST SQUARES 10.1 AND 10.2
Chapter 8	ORDINARY DIFFERENTIAL EQUATIONS
8.1	Taylor Series Method
8.2	Runge-Kutta Methods
Chapter 11	SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
11.1	Methods for First-Order Systems
11.2	Higher-Order Equations and Systems
11.3	Adams-Moulton Methods
Chapter 12	BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFF. EQUATIONS
12.1	Shooting Method
12.2	A Discretization Method

Fall, 1993
R. McCullough

MATHEMATICS COURSE CONTENT

MATH 360 OPERATIONS RESEARCH 3 Credits
Offered Fall of even numbered years

This course covers the main topics of operations research, including model formulation, linear programming, integer programing, nonlinear programming, network analysis, deterministic and stochastic dynamic programming, game theory, and decision theory.

Text: Schaum's Outline of Theory and Problems of Operations Research, by Richard Bronson, 1982

Prerequisite: MATH 231

CONTENT

CHAPTER	TOPIC	DAYS
Chapter 1	Mathematical Programming	3
Chapter 2	Linear Programming: Standard Form	3
Chapter 3	Linear Programming: Theory of Solutions	3
Chapter 4	Linear Programming: The Simplex Method	4
Chapter 5	Linear Programming: Duality	2
Extra Topic	Linear Programming: Karmarkar's Algorithm	2
Chapter 6	Integer Programming: Branch-and-Bound Algorithm	2
Chapter 7	Integer Programming: Cut Algorithms	2
Chapter 8	The Transportation Algorithm	3
Chapter 9	Scheduling Models	3
Chapter 10	Single-Variable Optimization	2
Chapter 14	Deterministic Dynamic Programming	2
Chapter 15	Network Analysis	3
Chapter 16	Game Theory	2
Chapter 17	Decision Theory	2
Chapter 18	Stochastic Dynamic Programming	2
	Tests	4
	Total days	45

Fall, 1993
V. Konecny

MATHEMATICS COURSE CONTENT

MATH 380 APPLIED ANALYSIS 3 Credits

Classical Applied Mathematics and its Applications. LaPlace Transforms, Fourier Series, Vector Calculus, Partial Differential Equations, Complex Functions and Applications.

Prerequisite: MATH 320 Analytic Geometry and Calculus 3

Text: Advanced Engineering Mathematics, by James A. Cochran, H. Clare Wiser, Bernhard J. Rice, 2nd Edition, Wadsworth, Inc. 1987

CONTENT

CHAPTER/SECTION	SUGGESTED TOPIC
Chapter 5	INTRODUCTION
5.1	Introduction
5.2	Definition of the Laplace Transformation
5.3	Existence of the Laplace Transform
5.4	Some General Properties
5.5	Transforming Periodic Functions
5.6	The Inverse Laplace Transform
5.7	Solutions to Ordinary Diff. Equations
5.8	A "Turn-On" Function
5.9	The Convolution Theroem
Chapter 7	FOURIER EXPANSIONS
7.1	Introduction
7.2	The Space PC (-L,L)
7.3	Two Kinds of Convergence
7.4	Fourier Coefficients
7.5	Alternate Expressions for Fourier Series
7.6	Subspaces of PC (-L,L)
7.7	Properties of Fourier Coefficients
7.8	Convergence of a Fourier Series
7.9	Sine and Cosine Series
7.10	Which Fourier Expansion to Use
7.11	An Application
Chapter 10	VECTOR CALCULUS: DIFFERENTIATION
10.10	Variation of a Vector Field: Divergence
10.11	Variation of a Vector Field: Curl

MATH 380 Applied Analysis (con't)

CHAPTER/SECTION	SUGGESTED TOPIC
Chapter 11	VECTOR CALCULUS: INTEGRATION
11.3	Evaluation of Line Integrals
11.4	Path Independence
11.5	Surface Area
11.6	Surface Integrals of Scalar & Vector Fields
11.7	Green's Theorem in the Plane
11.8	Stokes' Theorem
11.9	Divergence Theorem

**** The Choice of the Following Depends on the Instructor ****

Chapter 8	PARTIAL DIFFERENTIAL EQUATIONS
8.1	Introduction
8.2	Boundary Value Problem
8.3	Superposition
8.4	Two Methods
8.5	More on Separation of Variables
8.6	The Wave Equation
8.7	Solution by D'Alembert's Method
8.9	The Heat Equation
Chapter 12	COMPLEX FUNCTIONS
12.1	Introduction
12.2	Complex Numbers
12.3	The Complex Plane
12.4	Functions and Mappings
12.5	The Derivative of a Complex Function
12.6	Integral and Fractional Powers of z
12.7	The Exponential Function
12.8	Complex Trig. Functions
12.9	Inverse Functions
Chapter 13	MAPPING BY ANALYTIC FUNCTIONS
Chapter 14	INTEGRATION IN THE COMPLEX PLANE
Chapter 15	COMPLEX SERIES
Chapter 16	APPLICATIONS OF RESIDUE THEORY

Fall, 1993
G. Arnold

MATHEMATICS COURSE CONTENT

MATH 385 ACTUARIAL SCIENCE PROFESSIONAL EXAM PREPARATION I 1 credit

Prerequisite: MATH 320 and at least corequisite of MATH 322.

This course will help prepare students to take the Society of Actuaries' Professional Exam #100. Emphasis will be given to analysis of previous exams, study of sample questions, and general test taking techniques. Grading will be credit/no credit only.

MATHEMATICS COURSE CONTENT

MATH 414 MATHEMATICAL STATISTICS I 3 CREDITS

A theoretical course in probability and statistics including distributions and densities, expectation, moment generating functions and functions of random variables. (3 + 0)

Prerequisite: MATH 320

Text: Mathematical Statistics, 5th Edition, J. Freund, Prentice Hall

CONTENT

CHAPTER/SECTION	TOPIC
Chapter 1	Introduction
1.1	Introduction
1.2	Combinatorial Methods
1.3	Binomial Coefficients
Chapter 2	Probability
2.1	Introduction
2.2	Sample Spaces
2.3	Events
2.4	The Probability of an Event
2.5	Some Rules of Probability
2.6	Conditional Probability
2.7	Independent Events
2.8	Bayes' Theorem
Chapter 3	Probability Distributions
3.1	Introduction
3.2	Probability Distributions
3.3	Continuous Random Variables
3.4	Probability Density Functions
3.5	Multivariate Distributions
3.6	Marginal Distributions
3.7	Conditional Distributions
Chapter 4	Mathematical Expectation
4.1	Introduction
4.2	The Expected Value of a Random Variable
4.3	Moments
4.4	Chebyshev's Theorem
4.5	Moment-Generating Functions
4.6	Product Moments
4.7	Moments of Linear Combinations of Random Variables
4.8	Conditional Expectations

Math 414 Content cont.

CHAPTER/SECTION	TOPIC
Chapter 5	Special Distributions
5.1	Introduction
5.2	The Discrete Uniform Distribution
5.3	The Bernoulli Distribution
5.4	The Binomial Distribution
5.5	The negative Binomial and Geometric Distribution
5.6	The Hypergeometric Distribution
5.7	The Poisson Distribution
Chapter 6	Special Densities
6.1	Introduction
6.2	The Uniform Density
6.3	The Gamma, Exponential, and Chi-square Distributions
6.4	The Beta Distribution
6.5	The Normal Distribution
6.6	The Normal Approximation to the Binomial Distribution
6.7	The Bivariate Normal Distribution
Chapter 7	Functions of Random Variables
7.1	Introduction
7.2	Distribution Function Technique
7.3	Transformation Technique: One Variable
7.4	Transformation Technique: Two Variables
7.5	Moment-Generating Function Technique
	Review and Testing

Applied Mathematics/ Actuarial Science

APRC 1997-1998

Section 2

FALL 1993
G. ARNOLD

MATHEMATICS COURSE CONTENT

MATH 416 MATHEMATICAL STATISTICS II 3 CREDITS

A continuation of Math 414 including sampling distributions, estimation, hypothesis testing, regression, and ANOVA. (3 + 0)

Prerequisite: Math 414

Text: Mathematical Statistics, 5th Edition, J. Freund, Prentice-Hall

CONTENT

CHAPTER/SECTION	TOPIC
Chapter 8	SAMPLING DISTRIBUTIONS
8.1	Introduction
8.2	The Distribution of the Mean
8.3	The Distribution of the Mean: Finite Populations
8.4	The Chi-square Distribution
8.5	The t Distribution
8.6	The F Distribution
8.7	Order Statistics
Chapter 9	DECISION THEORY
9.1	Introduction
9.2	The Theory of Games
9.3	Statistical Games
9.4	Decision Criteria
9.5	The Minimax Criterion
9.6	The Bayes Criterion
Chapter 10	POINT ESTIMATION
10.1	Introduction
10.2	Unbiased Estimators
10.3	Efficient Estimators
10.4	Consistent Estimators
10.5	Sufficient Estimators
10.7	The Methoid of Moments
10.8	The Method of Maximum Likelihood
10.9	Bayesian Estimators
Chapter 11	INTERVAL ESTIMATION
11.1	Introduction
11.2	Confidence Intervals for Means
11.3	Confidence Intervals for Differences Between Means
11.4	Confidence Intervals for Proportions
11.5	Confidence Intervals for Differences Between Proportions
11.6	Confidence Intervals for Variances
11.7	Confidence Intervals for Ratios of Two Variances

FALL, 1993
R. Agrawal

MATHEMATICS COURSE CONTENT

MATH 420 AN INTRODUCTION TO ABSTRACT ALGEBRA 3 Credits

Groups, rings, integral domains, fields and their elementary properties. Equivalence relations, congruence, homomorphisms, and isomorphisms.

Prerequisite: MATH 230 and either MATH 324, MATH 322 or MATH 328

Text: A FIRST COURSE IN ABSTRACT ALGEBRA, 4th Edition, by John B. Fraleigh, Addison-Wesley Publishing Company

CONTENT

Chapter/Section		Topic
Chapter	0	A FEW PRELIMINARIES
	0.1	Mathematics and Proofs
	0.2	Sets and Equivalence Relations
Chapter	1	INTRODUCTION TO GROUPS
	1.1	Binary Operations
	1.2	Groups
	1.3	Subgroups
	1.4	Groups of Permutations
	1.5	Orbits, Cycles, and the Alternating Group
	1.6	Cyclic Groups
	1.7	Cosets and the Theorem of Lagrange
	1.8	Direct Products and Finitely Generated Abelian Groups
Chapter	2	HOMOMORPHISMS AND FACTOR GROUPS
	2.1	Homomorphisms
	2.2	Isomorphism and Cayley's Theorem
	2.3	Factor Groups
	2.4	Factor-Group Computations and Simple Groups
Chapter	4	INTRODUCTION TO RINGS AND FIELDS
	4.1	Rings and Fields
	4.2	Integral Domains
	4.3	Fermat's and Euler's Theorems
	4.4	The Field of Quotients of an Integral Domain
Chapter	5	FACTOR RINGS AND IDEALS
	*5.1	Homomorphisms and Factor Rings
	*5.2	Prime and Maximal Ideals

*AS TIME PERMITS

Fall, 1993
A. Khoury

MATHEMATICS COURSE CONTENT

MH 430 ADVANCED CALCULUS 3 Credits

A more rigorous approach to limits, continuity, and differentiation in multivariable calculus.

Prerequisite: MATH 320

Text: Advanced Calculus, 3rd Ed. by R. Creighton Buck, McGraw-Hill Publishing Company

CONTENT

CHAPTER/SECTION	TOPIC
Chapter 1	SETS AND FUNCTIONS
1.1	Introduction
1.2	R and R^n
1.3	Distance
1.4	Functions
1.5	Topological Terminology
1.6	Sequences
1.7	Consequences of the Monotonic-Sequence Property
1.8	Compact Sets
Chapter 2	CONTINUITY
2.1	Preview
2.2	Basic Definitions
2.3	Uniform Continuity
2.4	Implications of Continuity
2.5	Limits of Functions
2.6	Discontinuities
2.7	Inverses for Functions of One Variable
Chapter 3	Differentiation
3.2	Mean Value Theorems and L'Hospital's Rule
3.3	Deriuatives for Function on R^n

MATHEMATICS COURSE CONTENT

MATH 440 — MATHEMATICAL MODELING — 3 CREDITS

An introduction to the use of mathematics to form models of real world situations as an aid in solving problems related to them. Particular emphasis will be given to the use of graph theory as a modeling tool and to the proving of theorems.

PREREQUISITES: MATH 220. No knowledge of techniques for proving theorems or of graph theory is required.

TEXT: Graphs and Digraphs by Chartrand and Lesniak; Second edition, Wadsworth and Brooks/Cole, Inc. 1986. (Not required).
Graphs as Mathematical Models by Chartrand; Prindle, Weber, and Schmidt, Inc. 1977 (Not required - out of print)
Textbook and emphases above may vary depending on which faculty member is teaching the course.

TOPICS:

- Theorems and Proofs
- Mathematical Models
- Graphs
- Graphs as Mathematical Models
- Directed Graphs as Mathematical Models

Elementary Concepts of Graph Theory
- The degree of a vertex
- Isomorphic Graphs
- Connected Graphs
- Cut-vertices and Bridges

Transportation Problems
- The Konigsberg Bridge Problem: An introduction to Eulerian graphs.
- The Salesman's Problem: An introduction to Hamiltonian graphs

Connection Problems
- The Minimal Connector Problem: An introduction to trees
- PERT and the Critical Path Method

Games and Puzzles
- "Instant Insanity"
- The Tower of Hanoi
- Ramsey Numbers
- Matching

Digraphs and Mathematical Models
- A Traffic System Problem
- Tournaments
- Paired Comparisions and How to Fix Elections

Planar Graphs and Coloring Problems
- The Three Houses and Three Utilities Problem
- A Scheduling Problem: An Introduction to Chromatic Numbers
- The Four Color Problem

Graphs and Other Mathematics
- Graphs and Matrices
- Graphs and Topology
- Graphs and Groups

Fall, 1993
G. Arnold

MATHEMATICS COURSE CONTENT

MATH 485 ACTUARIAL SCIENCE PROFESSIONAL EXAM PREPARATION II 1 credit

Prerequisite: At least corequisite of MATH 416

This course will help prepare students to take the Society of Actuaries' Professional Exam #100. Emphasis will be given to analysis of previous exams, study of sample questions, and general test taking techniques. Grading will be credit/no credit only.

G. Lobo
Fall, 1993

MATHEMATICS COURSE CONTENT

CPSC 244 SCIENTIFIC PROGRAMMING IN FORTRAN 3 Credits

Coding Mathematical problems in FORTRAN 77. If software is made available FORTRAN 77 will be replaced with FORTRAN 90. MICROSOFT package used. Documentation, flowcharting, arithmetic statements, formatted input/output statements, control statements, arrays, functions, recursion, decision structures, subprograms and file processing. If time permits graphics and complex data types will also be covered.

PREREQUISITE: MATH 216 or MATH 230 or EQUIVALENT.

TEXT: FORTRAN 77 for Engineers and Scientists, Third Edition, Larry Nyhoff and Sanford Leestma, Macmillan Publishing Company.

CONTENT

Chapter 1 INTRODUCTION AND HISTORY
You should spend at most four lectures on this chapter and an introduction to the software that will be used.

Chapter 2 PROGRAMMING DEVELOPMENT
Spend at most three lectures on this Chapter.

Chapter 3 BASIC FORTRAN
- 3.1 Data + Algorithms = Programs.
- 3.2 Program Format.
- 3.3 Constants and Variables.
- 3.4 Arithmetic Operations and Functions.
- 3.5 The Assignment Statement.
- 3.6 List Directed Input/Output.
- 3.7 (OPTIONAL) Program Composition.

Chapter 4 STRUCTURED PROGRAMMING
- 4.1 Sequential Structure.
- 4.2 The Logical Data Type.
- 4.4 The IF Selection Structure.
- 4.5 Repetition Structure : DO Loops.
- 4.6 The While Repetition Structure.
- 4.7 The DO WHILE Statement.
- 4.8 (OPTIONAL) Implementing While Loops in Standard FORTRAN.
- 4.9 A Posttest Repetition Structure.

Chapter 5 INTRODUCTION TO SUBPROGRAMS AND MODULAR PROGRAMMING
- 5.1 Function Subprograms.
- 5.2 (OPTIONAL) Examples. May use your own examples.
- 5.3 Subroutine Subprograms.
- 5.4 (OPTIONAL) Examples. May use your own examples.
- 5.5 Functions and Subroutines as examples.
- 5.6 (OPTIONAL) The COMMON Statement.

Chapter 6 INPUT/OUTPUT
- 6.1 Formatted Output.
- 6.2 Examples - May use your own examples.
- 6.3 Formatted Input.
- 6.4 The WRITE Statement and the General READ Statement.
- 6.5 Introduction to File Processing.
- 6.6 (OPTIONAL) Examples - May use your own examples.
- 6.7 (OPTIONAL) Miscellaneous Input/Output Topics.

Chapter 7 ONE DIMENSIONAL ARRAYS
- 7.1 Introduction to Arrays : Scripted Variables.
- 7.2 Input/Output of Arrays.
- 7.4 Array Processing.

Chapter 8 MULTI DIMENSIONAL ARRAYS
- 8.1 Introduction to Multi dimensional Arrays.
- 8.2 Processing Multi dimensional Arrays.

Chapter 9 DOUBLE PRECISION AND COMPLEX DATA TYPES
- 9.1 Double Precision Type.
- 9.2 (OPTIONAL) Complex Type.

Chapter 10 ADVANCED CHARACTER DATA
- 10.1 Character Data and Operations.
- 10.2 The INDEX and LEN Functions.
- 10.3 Character Comparision.

OPTIONAL : If time permits then graphics, Chapters 11 - 13 may be covered.

FALL, 1993
Art Sherwood

COMPUTER SCIENCE COURSE CONTENT

CPSC 205 COMPUTER SCIENCE I 3 CREDITS

This course will deal with the fundamentals of structured programming using TURBO PASCAL. Emphasis will be given to concepts such as top-down design, basic structures (sequence, decisions, loops) and the use of procedures. Variable types; text files, records and graphics will also be covered. Mathematical/scientific applications will be stressed.

Prerequisite: MATH 126, Algebra and Analytic Trigonometry or MTH 130, Advanced Algebra & Analytic Trigonometry.

Text: Using Turbo Pascal 4.0 - 6.0, 2nd Edition, Julien Hennefeld, PWS-KENT Publishing Company, 1992.

CONTENT

CHAPTER	TOPIC
*1	Introduction to TURBO PASCAL
2	Using the TURBO System
3	More on the Elements of PASCAL
**4	IF-THEN-ELSE
5	CHAR & STRING Data Types/Formatting Output
6	FOR Loops
7	WHILE Loops
8	REPEAT-UNTIL Loops
9	TEXT Files
10	Introduction to Procedures
11	Procedures with Variable Parameters
12	Multiway Selection
***13	Functions
15	Nested Subprograms
17	One-Dimension Arrays
18	Sorting and Searching
19	Multidimensional Arrays and Nested Loops
21	Records
29	Graphics
*	Include a preview of the Appendices, especially Appendix D & F
**	Consider including Chapter 12 with Chapter 4
***	Consider introducing the Function Random (Chapter 14) as an example for Chapter 13

Fall, 1993
Art Sherwood

COMPUTER SCIENCE COURSE CONTENT

CPSC 310 ASSEMBLY LANGUAGE PROGRAMMING 3 Credits

A study of the microcomputer organization, machine language, assembly language and the set of instructions.

Prerequisite: MTH 126, algebra & Analytic Trigonometry or MATH 130, Advanced Algebra & Analytic Trigonometry.

Text: IBM PC Assembly Language and Programming, Second Edition, by Peter Abel, Prentice-Hall Publishing Company, 1991.

COURSE CONTENT

CHAPTER	
1	Introduction to PC Architecture
2	Machine Execution
3	Assembly Language Requirements
4	Assembling, Linking, and Executing a Program
5	Defining and Moving Data
6	COM Programs
7	Program Logic and Control
8	Introduction to Keyboard and Screen Processing
11	String Operations
12	Arithmetic I: Processing Binary Data
13	Arithmetic II: Processing ASCII Data
15	DISK Storage Organization
19	Printing
20	MACRO Writing
23-25	Used heavily for reference
9-10	Advanced Screen and Keyboard Processing Various topics used with other chapters)

Spring, 1993
R. McCullough

MATHEMATICS COURSE CONTENT

CPSC 215 DATA STRUCTURES 3 Credits

This course will cover the main types of data structures including stacks, queues, deques, lists, trees, recursion, sorting and searching techniques. It will emphasize, whenever possible, examples and applications of data structures.

Prerequisite: MATH 205, Structured Programming with Pascal, or knowledge of PASCAL Language.

Text: Applied Data Structures Using Pascal by Hale/Easton, D.C. Heath and Company, 1987

CONTENT

Chapter/Section	Topic	Days
Chapter 1	INTRODUCTION	
	Maintaining Employee Data	
	Pascal and Basic Procedures	
	The ReadData and WriteData Procedures	
	Sort, Add, Delete, and FindOne Procedures	
	Summary	
	Chapter Exercises	3
Chapter 2	LINKED LISTS	
	Pointer Variables	
	Linked Lists--Creation	
	Linked List Traversal	
	Procedure Parameters	
	Forward- and Backward-Pointing Linked Lists	
	Insertion and Deletion	
	Maintaining Sorted Linked Lists	
	EmployeeList Program	
	Summary	
	Chapter Exercises	7
Chapter 3	STACKS, QUEUES, AND OTHER LINKED LISTS	
	Stacks and Queues	
	Other Linked Lists	
	Long Integers	
	Arithmetic Expressions	
	Stacks Using Arrays	
	Summary	
	Chapter Exercises	6
Chapter 4	ELEMENTARY SEARCHING AND SORTING TECHNIQUES	
	Searching Techniques	
	The Selection Sort	
	The Bubble Sort	
	The Insertion Sort	
	Some Comparisons	
	Summary	
	Chapter Exercises	4

Spring, 1993
R. McCullough

MATHEMATICS COURSE CONTENT

CPSC 320 COMPUTER SIMULATIONS 3 Credits

This course will cover continuous and discrete simulations of real-life processes. The continuous system language DYNAMO and a general purpose high level programming language will be used.

Prerequisite: Knowledge of a high-level computer language
MATH 231

Text: None required, but material will be taken from:
Introduction to Computer Simulation, by Roberts, Anderson, Deal, and Scaffer, Addison-Wesley Publishing Co., 1983
and Simulation Using Personal Computers, by Carroll, Prentice-Hall, Inc., 1987.

CONTENT

(from Introduction to Computer Simulation)

PART V:	INTRODUCTION TO SIMULATION	
Chapter 13	Levels and Rates	5 days
Chapter 14	Simulation Using DYNAMO	3 days
Chapter 15	Using Simulation to Analyze Simple Positive and Negative Loops	2 days
Chapter 16	Representing More Complex Causal Relations	3 days
Chapter 17	Introduction to Delays	2 days
PART VI:	FORMULATING AND ANALYZING SIMULATION MODELS	
Chapter 18	Modeling the Ecology of the Kaibab Plateau	4 days
Chapter 19	Dynamic Characteristics of Flu Epidemics	2 days
Chapter 20	Urban Growth	2 days

(from Simulation Using Personal Computers)

Chapter 3	Random Numbers	4 days
Chapter 4	Time-Oriented Simulation	4 days
Chapter 5	Event-Oriented Simulation	4 days
Chapter 6	Distribution Functions	3 days
Chapter 9	GPSS for Personal Computers	2 days
	REVIEW AND TESTS	5 days
	Total days	45

Spring, 1993
G. Arnold

MATHEMATICS COURSE CONTENT

CPSC 326 COMPUTER GRAPHICS 3 credits

An overview of graphics hardware, object oriented programming, representation of curves and surfaces, wire frame representation, two and three dimensional transformaions, projection onto the display device, hidden line removal and programming for interaction.

Prerequisite: CPSC 215 and MATH 322 or consent of instructor

Text: Computer Graphics, by D Hearn and M. Baker

CONTENT

CHAPTER/SECTION	TOPIC
Chapter 1	A Survey of Computer Graphics
Chapter 2	Overview of Graphics Systems
Chapter 3	Output Primitives

Note: Chapter 1 - 3 should be covered quickly as an introduction.

Introduction to Pascal Objects.

Chapter 5	Two-dimensional Transformation
Chapter 6	Windowing and Clipping
Chapter 8	Interactive Input Methods
Chapter 9	Three-dimensional Concepts
Chapter 10	Three-dimensional Representations
Chapter 11	Three-dimensional Transformations
Chapter 12	Three-dimensional Viewing
Chapter 13	Hidden-surface and Hidden-line Removal
Chapter 14	Shading and Color Models

MATHEMATICS COURSE CONTENT

Spring 1997
Robert McCullough

CPSC 328 DISCRETE STRUCTURES 3 CREDITS

Discrete mathematics topics for Applied Mathematics and Computer Science, including: logic, sets, algorithms, recursion, combinatorics, graph theory and boolean algebra. Students cannot receive credit for both CPSC 328 and MATH 328.

Prerequisite: MATH 220, Analtical Geometry and Calculus I

Text: Discrete Mathematics by Richard Johnsonbaugh, 4th edition, Prentice Hall Publishing Co., 1997

CONTENT

CHAPTER/SECTION	TOPIC	DAYS
Chapter 1	**LOGIC AND PROOFS**	**6**
1.1	Propositions	
1.2	Conditional Propositions and Logical Equivalence	
1.3	Quantifiers	
1.4	Proofs	
1.6	Mathematical Induction	
Chapter 2	**THE LANGUAGE OF MATHEMATICS**	**7**
2.1	Sets	
2.2	Sequences and Strings	
2.3	Number Systems	
2.4	Relations	
2.5	Equivalence Relations	
2.6	Matrices of Relations	
2.8	Functions	
Chapter 3	**ALGORITHMS**	**7**
3.1	Introduction	
3.2	Notation for Algorithms	
3.3	The Euclidean Algorithm	
3.4	Recursive Algorithms	
	Complexity Algorithms	
3.6	Analysis of the Euclidean Algorithm	
Chapter 4	**COUNTING METHODS**	**7**
4.1	Basic Principles	
4.2	Permutations and Combinations	
4.3	Algorithms	
4.4	Generalized Permutations and Combinations	
4.5	Binomial Coefficients	
4.6	The Pigeonhole Principle	
Chapter 5	**RECURRENCE RELATIONS**	**4**
5.1	Introduction	
5.2	Solving Recurrence Relations	
5.3	Applications	
Chapter 6	**GRAPH THEORY**	**3**
6.1	Introduction	
6.2	Paths and Cycles	
Chapter 9	**Boolean Algebras**	**6**
9.1	Combinatorial Circuits	
9.2	Properties of Combinatorial C Circuits	
9.3	Boolean Algebras	
9.4	Boolean Functions	
9.5	Applications	
Review and Tests		**5**
TOTAL DAYS		**45**

Fall, 1993
V. Konecny

COMPUTER SCIENCE COURSE CONTENT

CPSC 350 LOGIC CIRCUIT DESIGN 3 Credits

Topics include basic logic design, commonly used codes, number representation and arithmetic, computer architecture (overview), and the study of an actual computer system.

Prerequisite: CPSC 310 or equivalent.

Text: Digital Design, Second Edition, by M. Morris Mano, Prentice-Hall 1991.

CONTENT

CHAPTER/SECTION	SUGGESTED TOPIC
Chapter 1	BINARY SYSTEMS
1.1	Digital Computers and Digital Systems
1.2	Binary Numbers
1.3	Number Base Conversion
1.4	Octal and Hexadecimal Numbers
1.5	Complements
1.7	Binary Codes
1.8	Binary Storage and Registers
1.9	Binary Logic
Chapter 2	BOOLEAN ALGEBRA AND LOGIC GATES
2.1	Basic Definitions
2.2	Axiomatic Definition of Boolean Algebra
2.3	Basic Theorems & Properties of Boolean Algebra
2.4	Boolean Functions
2.5	Canonical and Standard Forms
2.6	Other Logic Operations
2.7	Digital Logic Gates
2.8	Integrated Circuits
Chapter 3	SIMPLIFICATION OF BOOLEAN FUNCTIONS
3.1	The Map Method
3.2	Two- and Three-Variable Maps
3.3	Four-Variable Map
3.4	Five- and Six-Variable Maps
3.5	Product of Sums Simplification
3.6	NAND and NOR Implementation
3.7	Other Two-Level Implementations
3.8	Don't-Care Conditions
3.9	The Tabulation Method
3.10	Determination of Prime-Implicants

CPSC 350 Logic Circuit Design (con't)

Chapter/Section	Suggested Topic
Chapter 4	COMBINATIONAL LOGIC
4.1	Introduction
4.2	Design Procedure
4.3	Adders
4.4	Subtractors
4.5	Code Conversion
4.6	Analysis Procedure
4.7	Multilevel NAND Circuits
4.8	Multilevel NOR Circuits
4.9	Exclusive-or and Equivalence Functions
Chapter 5	MSI AND PLD COMPONENTS
5.1	Introduction
5.2	Binary Adder
5.3	Decimal Adder
5.4	Magnitude Comparator
5.5	Decoders
5.6	Multiplexers
5.7	Read-Only Memory (ROM)
5.8	Programmable Logic Array (PLA)
Chapter 6	SYNCHRONOUS SEQUENTIAL LOGIC
6.1	Introduction
6.2	Flip-Flops
6.3	Triggering of Flip-Flops
6.4	Analysis of Clocked Sequential Circuits
6.5	State Reduction and Assignment
6.6	Flip-Flop Excitation Tables
6.7	Design Procedure
6.8	Design of Counters
Chapter 7	REGISTERS, COUNTERS, AND THE MEMORY UNIT
7.1	Introduction
7.2	Registers
7.3	Shift Registers
7.4	Ripple Counters
7.5	Synchronous Counters
7.6	Timing Sequences
7.7	RAM

Fall, 1993
V. Konecny

COMPUTER SCIENCE COURSE CONTENT

CPSC 442 PROGRAMMING LANGUAGE CONCEPTS 3 CREDITS

Topics include definition and structure of a language, data types control structures and data flow, run time considerations, interpretive languages, and lexical analysis and parsing.

Prerequisite: CPSC 205, CPSC 215 and CPSC 310.

Text: The Anatomy of Programming Languages by Alice E. Fischer and Frances S. Grodzinsky
Prentice-Hall, Inc ,1993.

CONTENT

Chapter/Section	Suggested Topic
Chapter 4	FORMAL DESCRIPTION OF LANGUAGE
4.1	Foundations of Programming Languages
4.2	Syntax (Extended BNF, Syntax Diagrams)
4.3	Semantics
4.4	Extending the Semantics of a Language
Chapter 5	PRIMITIVE TYPES
5.1	Primitive Hardware Types
5.2	Types in Programming Languages
5.3	A Brief History of Type Declarations
Chapter 6	MODELING OBJECTS
6.1	Kinds of Objects
6.2	Placing a Value in a Storage Objects
6.3	The Storage Model: Managing Storage Objects
Chapter 8	EXPRESSIONS AND EVALUATIONS
8.1	The Programming Environment
8.2	Sequence Control and Communication
8.3	Expression Syntax
8.4	Function Evaluation
Chapter 9	FUNCTIONS AND PARAMETERS
9.1	Function Syntax
9.2	What Does an Argument Mean?
9.3	Higher-Order Functions
Chapter 10	CONTROL STRUCTURES
10.1	Basic Control Structures
10.2	Conditional Control Structures
10.3	Iteration
10.4	Implicit Iteration

Section 10
Enrollment Trends

The following table shows the official enrollment count in the applied mathematics and actuarial science program over the last five fall semesters.

	Fall 1993	Fall 1994	Fall 1995
Total	6	5	6
Freshmen	1	0	0
Sophomore	0	3	3
Junior	2	2	2
Senior	3	0	1
TBD	0	0	0

	Fall 1996	Fall 1997
Total	9	7
Freshmen	0	3
Sophomore	2	1
Junior	1	1
Senior	5	2
TBD	1	0

Over the last five years enrollment has averaged around six. Despite a fair amount of recruitment effort we have seen little increase in enrollment. The newly formed advisory committee has made several suggestions to help increase enrollment. They will be discussed in a later section.

Section 11
Program Productivity/Cost

The data available is from the 1995-96 academic year. The data from the Office of Institutional Studies ranks programs according to teaching cost. This list is obtained by looking at all the courses required by a particular program, determining the total teaching cost per student for taking all these courses, and then dividing this figure by the number of credit hours in the program. This is the best figure for the total cost of productivity of an overall program, because it includes all the courses in a program. Out of 134 programs on campus applied mathematics ranked 60th and actuarial science ranked 34th. This puts us close to the middle of programs. The actual cost per credit hour in the applied mathematics program was calculated as $130.79 and the actual cost per credit hour in the actuarial science program was calculated as $155.79. The highest cost per credit hour was $788.78 and the lowest cost per credit hour was $58.07. We are clearly closer to the lower end than the high end.

Section 12
Conclusions

In this section, the twelve areas of analysis raised by the APRC manual are addressed.

i. Centrality to FSU mission

The mission statements of the department of mathematics, the applied mathematics program, and the actuarial science program were constructed and approved within the context of the overall FSU mission. These documents are both readily available.

The actuarial science program from its inception has striven to place people in an environment which prepares students for actuarial positions. In a like manner the applied mathematics program has prepared students for jobs in industry dealing with statistics, computer science and mathematical modeling as well preparing students for graduate programs. In preparing people for the ever-changing world of applied mathematics, the programs have remained close to the basic Ferris tradition of preparing students to quickly become competent members of the industrial workforce. The graduate response section directly addresses this question, and it reinforces (especially in the comments) that the mission of preparation is being maintained.

ii. Uniqueness and visibility.

The actuarial science program is only one of a few in the state of Michigan and the same holds true for the applied mathematics program.

iii. Service to state and nation.

The applied mathematics program and the actuarial science program are providing a service to employers in both the state Michigan and throughout the nation.

iv. Demand by students.

According to data shown earlier in this report, the demand by students has remained constant over the last five years. Unfortunately the demand has been

rather low. Our advisory board has recommended a plan to help increase demand by students. This plan is summarized under recommendations.

v. Quality of instruction.

With regard to the instruction of students, the results of the surveys (of students, graduates, and advisory board members) are all quite clear. The student and faculty perceptions of the program and its instruction are quite high and sure to remain so as long as student preparation meets industrial demands.

vi. Demand for graduates.

The demand for graduates in applied mathematics particularly those with an emphasis in computer science or statistics has been high. Calls from employers are often received because of someone's contact with one of our graduates. The current demand for graduates is predicted to increase, due to the current economic health of the nation. The labor market analysis in a previous section attests to this point.

vii. Service to non-majors

The programs themselves do not provide, a large degree of service to non-majors. However, there are some ways in which non-majors benefit from the existence of the programs. The early mathematics courses are shared with a number of programs and the mathematics education program shares advanced courses.

viii. Facilities and equipment.

There are presently three classrooms equipped with a computer and large screen display. These classrooms are used for computer science courses and for courses in which Derive (a symbolic algebra system) is used. At present this is an adequate number of such rooms.

The main computing facility used by the students is located in ASC 1015. It consists of fifty Pentium workstations. This more than adequate for present usage.

In addition faculty sometimes bring students to the Computer seminar room in ASC 1008 or the small computer seminar room in STR 109. The computer seminar room in ASC 1008 has thirty-five Pentium workstations and large screen projection. The small computer seminar room in STR 109 has twenty Pentium workstations and large screen display. A computer classroom would be nice at a future date. There is also a need for compiler upgrades for our CPSC courses. Our equipment holdings and facilities could be considered at least adequate for the present job of preparing students for industry.

ix. Library information resources

While many programs have a difficulty with insufficient holdings in the library, the applied mathematics and actuarial science program do not. The need for traditional library services is satisfied by the Internet and on-line searches. The lack of applied mathematics journals is however a problem for faculty.

x. Cost.

This is an area that can be difficult to quantify. One way of measuring the cost is the expense of providing instruction for students. As mentioned before, reports produced through institutional studies indicates that among all the programs at Ferris, the instructional cost of the our programs can be characterized as moderate. Another cost of the program is the day-to-day expense in providing support for the programs. The main computer laboratory is shared with all of the College of Arts and Sciences. The classrooms with computer display would be needed to teach the calculus courses even if the programs did not exist.

xi. Faculty: professional and scholarly activities.

Many of the mathematics department faculty teach in these programs. Faculty professional development occurs in the mathematics program at a number of levels. Some of our faculty attend conferences, some present papers at conferences, some publish in journals and some consult.

xii. Administration effectiveness.

The administration of these program has been divided between the applied mathematics program coordinator and the mathematics department chair. The program coordinator has primarily been responsible for recruiting students, advising students, and making contacts with employers. The department chair has been responsible for setting aside a sufficient portion of the departmental budget for the day-to-day operation of the programs and for ensuring that a suitable schedule of courses is built. The cooperation between these two individuals has been excellent, so the local administration effectiveness is very good.

Section 13
Recommendations
Applied Mathematics and Actuarial Science Programs

Areas of Strengths:

1. Personalized advising and instruction.
2. Program is individualized by allowing students to choose area of specialization.
3. Job market for students with computer and statistics training.
4. The technological revolution in the job market.
5. Good alternative program for pre-pharmacy and pre-optometry students.

Areas of Concern:

1. Low enrollment.
2. Lack of recruitment of "blue chip" math students.
3. The amount of course substitutions necessitated by the canceling of low enrollment classes--often to the extent that the student's final program is of questionable quality.

Future Goals:

1. Increase enrollment by a minimum of three students per year over the next five years.
2. Revise the program along the lines suggested by the advisory board.
3. Create a new recruiting brochure.
4. Review community college programs and devise articulation avenues where possible.
5. Enhance the coordination between the admission's recruiter, the program coordinator, the mathematics department chair, and the College of Arts & Sciences academic counselors.

Recommendations (These recommendations are made in consultation with the newly formed advisory board.)

1. Rewrite the program description so that there is one applied mathematics program with a number of options. Suggested options are actuarial science, statistics, operations research, and computer science. This repackaging would be similar to what applied biology has done. It would enable recruiters and admissions people to use the appropriate key words with prospective students.
2. Actively recruit at community colleges.
3. Add an internship option.

4. Revise computer science courses in accordance with the advisory boards recommendations.
5. Revise and add statistics courses in accordance with the advisory boards recommendations.

Applied Mathematics Advisory Board Recommendations

Rick Neeley
Sam Burgess
John Scheible

Computer science courses:

1. Leave CPSC 205 and CPSC 215 as they are in terms of content but change the language of instruction to C++ or Ada95.
2. Combine CPSC 310 and CPSC 350 into one four credit course.
3. Add a course on Algorithm Analysis and Data Structures.
4. Change the language of CPSC 150 to Visual Basic.

Statistics courses:

1. Change Math 250 from a two credit to a three credit course so the topics can be covered in more depth.
2. Add a course on Sampling Techniques.

General Recommendations:

1. Have only one major with tracks corresponding to what is now the actuarial science program and the most popular paths taken in the current applied mathematics major. Suggested tracks are actuarial science, computer science, operations research, and statistics.
2. Have an internship course so that internships are a formal option.
3. As soon as the program changes are approved launch a major recruiting drive. Aim the drive at both community college transfers and entering freshmen.
4. The drive should include visiting both community colleges and high schools.

Plan for acting on the advisory board recommendations

1. Immediately submit a plan for restructuring the programs into a single program with tracks.
2. During the Fall 1997 semester begin work on revising MATH 250, adding a Data Structures and Algorithm Analysis course, combining CPSC 310 and CPSC 350, and adding a Sampling Techniques course.
3. Submit the work mentioned in 2 sometime in the Winter 1998 semester.
4. We have already put articulation agreements in place with a number of community colleges. The chair or the applied mathematics coordinator will make recruiting trips to both community colleges and high schools during the 1997-1998 academic year.

Applied Mathematics Program (restructured to be submitted in Fall 1997)

Common Core:

CPSC 205	-	3
CPSC 215	-	3
MATH 220	-	5
MATH 230	-	5
MATH 320	-	3
MATH 322	-	3
MATH 340	-	3
MATH 360	-	3

Computer Science Track:

MATH 250	-	2
CPSC 310	-	3
CPSC 328	-	3
CPSC 442	-	3
CPSC electives		6
electives		23 (chosen from MATH, CPSC, or ISYS.)

Statistics Track:

MATH 250	-	2
MATH 314	-	3
MATH 414	-	3
MATH 416	-	3
electives		29 (from MATH, CPSC, BIOL, CHEM, or PHYS)

Actuarial Science Track:

MATH 250	-	2
MATH 314	-	3
MATH 414	-	3

MATH 416	-	3
CPSC 328	-	3
MATH 385	-	1
MATH 485	-	1
ECON 221	-	3
ECON 222	-	3
INSR 243	-	3
INSR electives		6
electives		9 (from MATH, INSR, ECON, ACCT, or STQM)

Operations Research Track:

CPSC 328	-	3
MATH 330	-	3
MATH 380	-	3
MATH 414	-	3
MATH 440	-	3
electives	-	6 (from MATH and CPSC)
electives	-	20 (from application area)

Appendix I

PROGRAM REVIEW PANEL EVALUATION

Program: Applied Mathematics / Actuarial Science

Instructions: Circle the number which most closely describes t he program you are evaluating.

1. Student Perception of Instruction — Average Score 4.33

5	4	3	2	1
Currently enrolled students rate instructional effectiveness as extremely high.				Currently enrolled students rate the instructional effectiveness as below average.

2. Student Satisfaction with Program — Average Score 4.17

5	4	3	2	1
Currently enrolled students are very satisfied with the program faculty, equipment, facilities, and curriculum.				Currently enrolled students are not satisfied with program faculty, equipment, facilities, or curriculum.

3. Advisory Committee Perceptions of Program — Average Score 4.17

5	4	3	2	1
Advisory committee members perceive the program curriculum, facilities, and equipment to be of the highest quality.				Advisory committee members perceive the program curriculum, facilities, and equipment needs improvement.

4. Demand for Graduates — Average Score 4.5

5	4	3	2	1
Graduates easily find employment in field.				Graduates are sometimes forced to find positions out of their field.

5. Use of Information on Labor Market — Average Score 4.17

5	4	3	2	1
The faculty and administrators use current data on labor market needs and emerging trends in job openings to systematically develop and evaluate the program.				The faculty and administrators do not use labor market data in planning or evaluating the program.

6. Use of Profession/Industry Standards Average Score 4.6

5 4 3 2 1

Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluating this program and content of its courses.

Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.

7. Use of Student Follow-up Information Average Score 4

5 4 3 2 1

Current follow-up data on completers and leavers are consistently and systematically used in evaluating this program.

Student follow-up information has not been collected for use in evaluating this program.

8. Relevance of Supportive Courses Average Score 4.33

5 4 3 2 1

Applicable supportive courses are closely coordinated with this program and are kept relevant to program goals and current to the needs of students.

Supportive course content reflects no planned approach to meeting needs of students in this program.

9. Qualifications of Administrators and Supervisors Average Score 4.5

5 4 3 2 1

All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability.

Persons responsible for directing and coordinating this program have little administrative training and experience.

10. Instructional Staffing Average Score 4.5

5 4 3 2 1

Instructional staffing for this program is sufficient to permit optimum program effectiveness.

Staffing is inadequate to meet the needs of this program effectively.

11. Facilities Average Score 3.67

5 4 3 2 1

Present facilities are sufficient to support a high quality program.

Present facilities are a major problem for program quality.

12. Scheduling of Instructional Facilities Average Score 4.17

5 4 3 2 1

Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction.

Facilities and equipment for this are significantly under-or-over scheduled.

13. Equipment Average Score 3.83

5 4 3 2 1

Present equipment is sufficient to support a high quality program.

Present equipment is not adequate and represents a threat to program quality.

14. Adaption of Instruction Average Score 3.83

5 4 3 2 1

Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as, small group or individualized instruction, laboratory or "hands on" experiences, credit by examination).

Instructional approaches in this program do no consider individual student differences.

15. Adequate and Availability of Instructional Materials and Supplies Average Score 4

5 4 3 2 1

Faculty rate that the instructional materials and supplies as being readily available and in sufficient quantity to support quality instruction.

Faculty rate that the instructional materials are limited in amount, generally outdated, and lack relevance to program and student needs.

CURRICULUM VITAE

VACLAV KONECNY

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Ph.D. (Phys. & Math Sciences), Tech. Univ., Brno (1968)
RNDr. (Doctor of Natural Sciences in Theoretical Physics),
Univ. J. E. Purkyne, Brno (1966)
M.S./ B.S. (Physics), Masaryk's University, Brno (1958)

EMPLOYMENT: 9/2/1980 to present: Prof. in Math, Ferris State University, Big Rapids, Michigan 49307.
1976-1980: Assoc. Prof. in Math & Physics, Jarvis Christian College, Hawkins, Texas 75765.
1973-1976: English-Czech Scientific Translator, Potoky, Gottwaldov Czechoslovakia.
1970-1973: Assoc. Prof. in Math, Jarvis Christian College, Hawkins, Texas 75765.
1970 (6 months): Post-Doctorate Fellow in Math, University of Saskatchewan, Saskatoon, Sask., Canada.
1964-1970: Lecturer in Math, University of Khartoum, Sudan.
1958-1964: Lecturer in Physics, Technical University, Brno, Czechoslovakia.
1952-1953: Lab. Assistant, Physics Lab., Research institute, Gottwaldov, Czechoslovakia.

COMPUTER EXPERIENCE: Scientific Programmer during Summers 1982 & 1981 at York University. Texas College of Osteopathic Medicine (Summer 1980), Howard Univ. (Summers 1978 & 1977). I.B.M -San Jose Summer 1973. Used mainly Fortran, Pascal and Assembly languages.

PUBLICATIONS: (See the enclosed list of publications). In the following fields: Diff. Equations, Combinatorics, Solid State Physics, Optics, Mechanics and Problem Solving.

PROFESSIONAL MEMBERSHIP: The Mathematical Association of America.

Vaclav Konecny

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2. "Arithmetic-Geometric Mean Inequality", Math. Mag.,Vol.45, No.3,1972(#807)
3. "Tangents of Inverse Functions", Math. Mag., Vol.45, No.4, 1972, (#814)
4. "Euler's ϕ Function", Math. Mag., Vol.45, No.5, 1972, (#823)
5. "Q 532", Math. Mag., Vol.45, No.5, 1972
6. "A Relation Between Two Angles", Math. Mag., Vol.46, No.1, 1973, (#825)
7. "Proposal #5878", Amer. Math. Monthly, Vol.79, No.9, 1972
8. "A Well-known Triangle Property", Math.Mag., Vol.46, No.2, 1973, (#837)
9. "A Problem of Meeting", Math.Mag., Vol.47, No.2, 1974, (#*868)
10. "Irrational Sides", Math.Mag., Vol.48, No.3, 1975, (#901)
11. "Interchanged Digits", Math.Mag., Vol.48, No.4, 1975, (#908)
12. "Coplanar Points", Math.Mag., Vol.50, No.3, 1977, (#962)
13. "Elliptical Tangents", MONTHLY, Vol.95., No.7, 1988, (E1364)
14. "Nonintuitive Exponentials", Math.Mag., Vol.62, No.1, 1989 (proposal 1313)
15. "Generalization of Gergonne Point", Math.Mag., Vol.62, No.2, 1989 (pr 1320)
16. "Quadrilateral Subdivision", Math. Mag., Vol.64, No.4., 1991, (#1354)
17. "Concurrent Cevians",Crux Mathematicirum, Vol.18, No.4, 1992 (pr 1731)
18. "Graphs of Exponential and its Inverse", Crux M., Vol.18, No.5, 1992 (pr 1744)
19. "Problem #1683 ", Crux M., Vol.18, No.8, 1992

Vaclav Konecny

LIST OF PUBLICATIONS (We list only the problem numbers, Journal, and the Year)
* means Unsolved problem before

20. # 1731* , Crux (1993) , Proposal.
21. # 1744 , Crux (1993) , Proposal.
22. # 1759 , Crux (1993)
23. # 1792 , Crux (1993)
24. # 1887 , Crux (1993), Proposal
25. # 1930 , Crux (1994), Proposal
26. # 1860* , Crux (1994)
27 # 1870* , Crux (1994)
28. # 1872* , Crux (1994), Comment
29. # 1887 , Crux (1994)
30. # 21 , Math Horiz. (1995) , Proposal
31 # 1461 , Math Mag. (1994) , Proposal
32. # 2035 , Crux (1995)
33. # 2045 , Crux (1995)
34. # 1960 , Crux (1995)
35. # 2035 , Crux (1995) , Proposal
36 . # 2045 , Crux (1995) , Proposal
37. # 1960 , Crux (1995)
38. # 1981 , Crux (1995)
39. # 1461 , Math. Mag. (1995) , Proposal
40. # 2034 , Crux (1995) , Coauthor
41. # 46 , Math. Horiz. (1996)
42. # 2035 , Crux (1996) , Proposal
43. # 2045 , Crux (1996) , Proposal
44. # 52 , Math Horiz. (1966) Proposal
45. # 2077 , Crux (1996)
46. # 2183 , Crux (1996), Proposal
47. # 68 , Math Horiz. (1997) , Proposal
48. # 2205 , Crux (1997) , Proposal
49 . # S3 , Math Horiz (1997) , Proposal
50 . # 68 , Math Horiz. (1997) , Solution of my proposal.
51. # 87 , Math Horiz. (1997)

John C. Hansen
19378 Golfview Dr.
Big Rapids, MI 49307

Home Phone: (616) 796-7999 E-mail: hansen905@aol.com
Office Phone: (616) 592-2565 E-mail: jhansen@art01.ferris.edu

Education

B.A.	Mathematics	University of Miami	1968
M.S.	Mathematics	Ohio University	1970
Ph.D.	Computer Science	Michigan State University	1974

Full-time Academic Experience

Instructor	Central Michigan University	8/72-6/74
Assistant Professor	University of Missouri-Rolla	8/74-8/76
Assistant Professor	University of Michigan-Flint	8/76-6/79
Associate Professor	Xavier University	9/79-8/82
Associate Professor	Central Michigan University	8/82-5/85
Professor	Central Michigan University	6/85-6/92
Professor	Ferris State University	7/92-

Administrative Duties

Acting Chairman
Computer Science Program
University of Michigan-Flint
6/78 to 6/79

Acting Chairman
Department of Computer Science
Central Michigan University
8/82 to 8/83

Head
Department of Mathematics
Ferris State University
7/1/92 to 6/1/95

Chairman
Department of Computer Science
Central Michigan University
8/83 to 6/85

Director
Pearce Hall Computer Center
Central Michigan University
8/82 to 6/85

Chair
Department of Mathematics
Ferris State University
5/15/97 to present

Industrial Experience

I have done a fair amount of consulting. During the times I have had nine month appointments I have usually worked full time in industry during the summer.

Areas of Interest

Software Engineering, Object-Oriented Design, Risk Analysis, Applied Statistics, Artificial Intelligence, Cryptography, Formal Language Theory, Data Base Design, Operating Systems

Professional Affiliations

ACM (Association for Computing Machinery)
IEEE (Institute of Electrical and Electronics Engineers)
ASA (American Statistical Association)
MAA (The Mathematical Association of America)

Research Activities

"Algebraic Properties of Processes", presented at the 1974 Computer Science Conference, Detroit, MI., February 1974.

"Structural Properties of Processes", Technical Report TR-02, College of Engineering, Michigan State University, 1974. (This is my thesis. The Department published it as a technical report)

"A Process Decomposition Theorem", Congressus Numerantium, Vol. 14, pp. 401-404, February 1975.

"Some Applications of a General Theory of Digraph Measures", Proceedings of the 1975 International Symposium on Multiple Valued Logic, pp. 262-276, May 1975.

"Correcting for Guessing on Multiple-Choice Tests", presented at the Fifth Manitoba Conference on Numerical Mathematics and Computing, October 1975. (with E.A. Hansen)

"A Program-Like Definition of Processes", presented at the Fifth Manitoba Conference on Numerical Mathematics and Computing, October 1975.

"Self-Modifying Systems", Congressus Numerantium, Vol. 16, pp. 351-374, October 1975 (with K. Marse)
"The Learning Problem for Conversational Artifacts", Proceedings of the Fourth Texas Conference on Computing Systems, pp. 1B-4.1 to 1B-4.4, November 1975.

"Computational Models of Learning", Proceedings of the Fourth Texas Conference on Computing Systems, pp. 1B-3.1 to 1B-3.6, November 1975. (with A.R. DeKock and K. Marse)

"A Model for the Correction for Guessing on Multiple-Choice Tests", SIGSOC Bulletin, Vol. 7, pp. 24-28. (with E.A. Hansen and F.L. Schmidt) Winter 1976.

"The Twist Group of a Digraph", presented at the Seventh Southeastern Conference on Combinatorics, Graph Theory and Computing, Baton Rouge, Louisiana, February 1976.

"INTERPLOT - An Interactive Graphics Software Package", Presented at the Seventh Manitoba Conference on Numerical Mathematics and Computing, September 1977. (with E.A. Hansen and K.H. Derus)

"Integrating Team Dynamics and On-The-Job Training into the Undergraduate Program", presented at the Fifth Annual Mountain Regional Computing Conference, Albuquerque, New Mexico, October 1977. (with K.H. Derus)

"FACTOR: A Special Purpose Computer for Factorization of Very Large Numbers", presented at the Fifth Annual Mountain Regional Computing Conference, Albuquerque, New Mexico, October 1977. (with K.H. Derus)

"Interactive Building of Models of Problem Solving Behavior", presented at 1978 ACM Computer Science Conference, Detroit, MI., February 1978. (with H.M. Braunstein)

"Integrating a Mini Computer into the Undergraduate Curriculum", presented at the 1978 ACM Computer Science Conference, Detroit, MI., February 1978. (with H.L. Reif)

"Logics without Logical Operators", presented at the 8th Manitoba Conference on Numerical Mathematics and Computing, October 1978. (with K.H. Derus)

"Computer Crime", presented at 1978 MACUL Conference, Flint, MI., June 1978.

"Team Dynamics and the Undergraduate Curriculum", SIGCSE Bulletin, pp. 28-29, December 1978. (with E.A. Hansen and K.H. Derus)

"Logics of Truth and Dispositions and Multiple Truth Values", SIGACT News, Vol. 11 No. 2, pp. 30-35, Fall 1979. (with K.H. Derus)

"Models of Assault on Medical Information Operating Systems", Proceedings of the Hawaii International Conference on Systems Sciences-13, pp. 308-315, January 1980. (with K.H. Derus and E.A. Hansen)

"Crimes Against Computer State Space", The Printout, pp. 22-24, February 1980. (with E.A. Hansen and K.H. Derus)

"Simulation of the Effect of Acid Rain on Lake Phenomena", Proceedings of the Hawaii International Conference on Systems Science-14, pp. 937-944, January 1981. (with E.A. Hansen, K.H. Derus and L.J. Latimore)

"Comparing Survival Data", Proceedings of the Hawaii International Conference on Systems Sciences-14, pp. 168-179, January 1981. (with E.A. Hansen and P.S. Gartside)

"Personal Computers in the Undergraduate Curriculum: An Example", SIGCSE Bulletin, pp. 11-14, Vol. 14, No. 3, September 1982. (with J.P. Kelsh)

"Computers in the Laboratory", presented at the Laboratory Professionals of Michigan Spring Seminar 83, Flint, MI., April 1983.

"Using Off-the-shelf Microcomputers in Psychological Experiments", Proceedings of MEDCOMP-3, October 1983. (with H.M. Wall, L.J. Latimore, and W.B. Reed)

"Some Design Considerations for a "C" Source Code Pretty Printer", SIGSMALL/PC NOTES, May 1985, pp. 16-22 (with Brad Sands)

"Reasonably Priced Compilers and Interpreters for the IBM-PC and PC Compatibles", SIGPLAN Notices, April 1986, vol. 21 number 4, pp. 67-69 (with J.P. Kelsh)

"A Simple Virtual Machine", SIGSMALL/PC NOTES, February 1987, vol. 13 number 1 , pp. 11-15 (with J.P. Kelsh)

"Indentation Styles in C",SIGSMALL/PC NOTES, August 1987, vol. 13 number 3, pp. 20-23 (with Roger Yim)

"Pixel Preference", Proceedings of the 1988 Computer Science Conference, February 1988, pp. 88-94 (with H.M. Wall and G.L. VanMeer)

"Undergraduate Compiler Construction: Compiler Writing by Example", Interface: The Computer Education Quarterly, Spring 1989, (with Roger Yim)

"Graphic and Object-Oriented Design Using HyperCard", Proceedings of the 23rd Small College Computing Symposium, April 1990. (with Roger Yim and Bryan Monroe)

"Software Engineering Training: Industrial and Academic Cooperation", presented at the Second Great Lakes Computer Science Conference, October 17-19, 1991 at Kalamazoo, Michigan.(with Roger Yim Lee)

Panel: "The Impact of Machine Learning on Expert Systems", ACM Computer Science Conference, Feb. 16-18, 1993 at Indianapolis, Indiana.

"Success with a Graduate Software Engineering Program: A Nontraditional / Interdisciplinary Program" , presented at the 15th Annual Conference of the Association for Integrative Studies, Oct. 7-10, 1993 at Detroit, Michigan (with Roger Yim Lee)

"Visual Object-Oriented Programming Using Delphi", proceedings of 14th Annual International Conference of the Association of Management, Aug. 2 - 6, 1996 at Toronto, Ontario, Canada.

"Models of Attack on Computer Systems and Chaos Theory", proceedings of 15th Annual International Conference of the Association of Management, Aug. 6 - 9, 1997 at Montreal, Quebec, Canada.

Grant

NSF Grant: CSI-8552113 High Resolution Computer Graphics and Image Processing Facility $14,612

Book

"Software Engineering: A Project Oriented Approach" with C.D. Sigwart and G.L. VanMeer; Franklin, Beedle & Associates, 1990, ISBN 0-938661-27-2

Other

Referee 1976-1979 NCC (National Computer Conference), Referee 1978 ACM, Referee HICSS-13 (13 th Hawaii International Conference on Systems Science), Session Chair HICSS-14, Referee HICSS-17, Referee HICSS-19, Referee 1990 ACM Computer Science Conference
Member of the Advisory Board, "Computers in Society", Annual Editions (1st to 4th Editions)
Named Best Boss in Mecosta County 1993 -- Best of Mecosta County People's Choice Awards.

Courses Taught

Computer Science I, Computer Science II, Pascal, Ada, FORTRAN, BASIC, COBOL, C, C++, File Manipulation, Assembler, Data Structures, Computer Organization, Discrete Structures, Systems Programming, Operating Systems, Data Base Design, Logic Circuit Design, Programming Languages, Compiler Construction, Formal Languages, Switching Theory, Automata Theory, Artificial Intelligence, Advanced Computer Organization, Advanced Software Design and Development, Software Engineering, Principles & Applications of Software Design, Software Generation & Maintenance, Graphics, Cryptography, Intermediate Algebra and Trigonometry, Pre-Calculus Mathematics, Calculus I II & III, Statistics for the Life Sciences, Simulation, Mathematical Statistics I and II, Quantitative Applications in Decision-Making, Operations Research, Probability, Linear Models

CURRICULUM VITAE

Personal: **Dr. Lakshmi Mukundan**
Associate Professor of Mathematics
Ferris State University
Big Rapids, MI 49307
Phone: Home: (616) 796 - 2703
Office: (616) 592 - 2567

Education:

Ph. D. (1991) North Carolina State University, Raleigh, NC.
Applied Mathematics with minor in Electrical Engineering.

M. Phil. (1982-84, Part-Time) Madras University, India.
Mathematics with Dissertation on Monotone Approximation.

M. Sc. (1968) Madras University, India.
Mathematics. Optional Subjects: Complex Variables & Topology.

B.Sc. (1966) Madras University, India.
Mathematics with Ancillary Subjects: Statistics & Physics.

Employment:

1996 - Present: Associate Professor of Mathematics
Ferris State University, Big Rapids, MI.

1991 - 1995 Assistant Professor of Mathematics
Ferris State University, Big Rapids, MI.

1986 - 1991: Teaching / Research Assistant, North Carolina State University, Raleigh, NC.

1980 -1985: Professor of Mathematics, Queen Mary's College Madras, India.

1972 - 1980: Assistant Professor of Mathematics, Queen Mary's College, Madras, India.

1970 - 1972: Assistant Professor of Mathematics, Government Arts College for Women, Kumbakonam, Madras, India.

Computing Experience:

Languages: Basic, Pascal, and Fortran.
Computer Algebra Systems: Derive and Matlab.

Publications:

C. T. Kelley and L. Mukundan: Convergence Analysis for the Harmonic Balance method, Journal of Nonlinear Analysis, Theory, Methods & Applications, Vol. 20, No. 4, pp. 365 - 380, 1993.

D. E. Stoneking , R. J. Trew, and L. Mukundan: Simulation of the Variation and Sensitivity of GaAs MESFET Large-Signal Figures of Merit Due to Process and Bias Parameters, Proceedings IEEE/ Cornell Conference on Advanced Concepts in High Speed Semiconductor Devices and Circuits, 1989, pp 228-236.

Professional Memberships:

Society of Industrial and Applied Mathematics.
Mathematical Association of America.
Michigan Section of Mathematical Association of America.
Michigan Education Association.

Conferences:

Presented Hands-on Sessions on Probability on March 11, 1995 at " Math, Science, Technology Access for All " Conference, organized by Mecosta Osceola Intermediate School District.

Equity Within the Classroom V - Graduating Minority Students Conference, March 24-25, '95, Lansing.

Equity Within the Classroom IV - Graduating Minority Students Conference, March 25-26, '94, Lansing.

Presented a talk on " Women and their Issues - Around World- With reference to India'' , March 3, '94, under the auspices of Forum for the Healing Racism, Big Rapids.

Equity Within the Classroom III- Graduating Minority Students Conference, March 26-27, '93, Lansing.

Fourth Annual Michigan Conference on College Mathematics: Calculus in Transition, March 23, '93, at University of Michigan, Dearborn, MI.

Given a contributed talk in the Tenth Annual South Eastern Atlantic Regional Conference on Differential Equations, Nov. 17, 1990 at Virginia Polytechnic Institute and State University, Blacksburg, VA.

Assignments At Ferris:

Teaching

Mathematics 110/111	Fundamentals of Algebra
Mathematics 115/121	Intermediate Algebra
Mathematics 116	Intermediate Algebra & Numerical Trig.
Mathematics 120/124	Trigonometry
Mathematics 125/130	Adv. Algebra & Analytical Trig.
Mathematics 126	Algebra & Analytical Trig.
Mathematics 122/128	Mathematical Analysis for Business I
Mathematics 135/133	Calculus for Life Sciences
Mathematics 162	Applied Algebra & Trigonometry 2
Mathematics 231/220	Analytical Geometry & Calculus 1
Mathematics 232 /230	Analytical Geometry & Calculus 2
Mathematics 234 /320	Analytical Geometry & Calculus 3
Mathematics 241/340	Numerical Methods/Analysis
Mathematics 250	Biostatistics
Mathematics 260	Statistics for Life Sciences
Mathematics 314	Probability
Mathematics 322	Linear Algebra
Mathematics 414	Mathematical Statistics 1
Mathematics 385	Prof. Actuarial Exam 100

Non Teaching

Passed the Actuarial Science Examination 100, Feb. '95 and Examination 110, May, '95 conducted by the Society of Actuaries.

Assisted in Registration for Fall '92, Spring '93, Fall '93, and Fall '94.

Recording Secretary for Department meetings during Winter '92-'93 and Spring '93.

Advisor for Pre-Science students during Fall '93, Winter '94, Fall '94, Winter '95, and Fall '95.

Member of the team: ' Diversity Counts! Project '

Participated in International Festival - April '93 and April '94, and April '95, organized by Center for International Education, Ferris State University.

Committee Service :

Department Planning Committee member.

Department Faculty Development Committee member.

Applied Mathematics Committee member.

Mathematics Education Committee member.

Statistics Committee member.

Text Book and Course Outline Committee member for the following Courses: Math 120, 130, 322, 324, 340, and 380 during Fall '92, Winter '92-'93, and Spring '93.

Text Book and Course Outline Committee member for the following Courses: Math 130, 220, 230, and 320, during Fall '93, Winter '94, Fall '94, Winter '95, and Fall '95.

Member of College of Arts and Sciences Sabbatical Leave Committee for 1994-1995, and 1995-96.

Chair of College of Arts and Sciences Sabbatical Leave Committee for 1995-1996.

Member of the Advisory Committee and Conference Handbook Committee for the ' Math, Science, Technology Access For All ' Conference, March 1995, organized by Mecosta Osceola Intermediate School District.

Member of College of Arts and Sciences Promotion Committee for 1996-1997, and 1997-98.

Ram K. Agrawal

Department of Mathematics
Ferris State University
Big Rapids, MI 49307
616-592-2574

17325 Outer Drive
Big Rapids, MI 49307
616-796-0362

Education:

Ph.D. in Mathematics (1974)
Michigan State University
East Lansing, Michigan

Title of the Doctoral Dissertation: The Structure of the Generalized Center and Hypercenter of a Finite Group.
Major Professor: Dr. W.E. Deskins
Area of Specialization: Abstract Algebra

M.S. in Mathematics (1959)
Agra University
Agra, India

B.S. in Mathematics, Physics, and Chemistry (1957)
Agra University
Agra, India

Research Papers:

1. The influence on a finite group of its permutable subgroups, Canad. Math. Bull. 17 (1974), 159-165.
2. Finite groups whose subnormal subgroups permute with all Sylow subgroups, Proc. Amer. Math. Soc. 47 (1975), 77-83.
3. Generalized center and hypercenter of a finite group, Proc. Amer. Math. Soc. 58 (1976), 13-21.

Fellowships and Grants:

Received Agra University Fellowship for two years in M.S. and Government Scholarship for two years in B.S.

Employment:

1970 - Present	Assistant Professor (1970-78) Associate Professor (1978-84) Professor (1984-Present) Ferris State University Big Rapids, Michigan
1965 - 1970	Graduate Teaching Assistant Michigan State University East Lansing, Michigan
1959 - 1965	Assistant Professor of Mathematics S.M. College, India U.P.A. University, India M.N.R. Engineering College, India

Visiting Position:

I was a visiting professor at the University of Pittsburgh for the summer of 1978, and taught two courses, one on Number Theory and the other on Abstract Algebra.

Professional Meetings:

October, 1987	Michigan Engineering College/Community College Liason Committee Jackson Community College Jackson, Michigan
October, 1985	Michigan Engineering College/Community College Liason Committee Kalamazoo Valley Community College Kalamazoo, Michigan
August, 1981	American Mathematical Society (summer meeting) University of Pittsburgh Pittsburgh, Pennsylvania

Teaching Assignments:

MTH 090	Fundamentals of Mathematics
MTH 111	Fundamentals of Algebra
MTH 116	Data Processing Mathematics
MTH 121	Intermediate Algebra
MTH 124	Trigonometry
MTH 125	Advanced Algebra and Analytical Trigonometry
MTH 128	Mathematical Analysis for Business
MTH 129	Calculus for Business
MTH 133	Calculus for the Life Sciences
MTH 161	Applied Algebra and Trigonometry 1
MTH 231	Analytical Geometry and Calculus 1
MTH 232	Analytical Geometry and Calculus 2
MTH 233	Analytical Geometry and Calculus 3
MTH 234	Analytical Geometry and Calculus 4
MTH 322	Linear Algebra
MTH 421	An Introduction to Abstract Algebra

Non-Teaching Assignments:

Chairperson of the College of Arts and Sciences Pre-Engineering Curriculum Committee from 1984 to 1990.

Member of various departmental committees (past and present) including Tenure, Pre-Engineering Curriculum, Applied Mathematics Program, Workload, and Departmental Planning Committees.

Currently responsible for the course outlines, textbook selections, and proficiency tests for MTH 133 and MTH 421. Previously responsible for these tasks for MTH 421 and MTH 431. Member of several other course committees in the past.

Active involvement in the mathematics department's faculty searches, semester conversion, and Actuarial Science degree program development.

Curriculum Vitae:

Robert N. McCullough
15145 180th Avenue
Big Rapids, Michigan
49307

(616)-796-3986

Education:

Additional graduate work, 1978 - 1979
West Virginia College of Graduate Studies
Major: Industrial Engineering and Systems Analysis
GPA: 4.00

M.S. degree, 1971
Michigan State University
Major: Mathematics
GPA: 3.90

B.S. degree, 1970
Michigan State University
Major: Mathematics
GPA: 3.50

Employment:

College teaching, Fall, 1981 to present
Ferris State University
Department of Mathematics

College teaching, Winter, 1980-81 to Summer, 1981
West Virginia College of Graduate Studies
Management Department

College teaching, Fall, 1974 to Summer, 1981
West Virginia State College
Department of Mathematics

Computer operations, Summer, 1973 to Summer, 1974
Oldsmobile - Main Plant

College teaching, Winter, 1972-73 to Summer, 1973
Jackson Community College
Department of Mathematics

Bookkeeper and Treasurer, Spring, 1972 to Fall, 1972
LeConte Lodge

College teaching, Fall, 1970 to Winter, 1972
Michigan State University
Department of Mathematics

Publications:

The Wright Stuff, UMAP Journal, Summer, 1992, pp. 113-132 and cover

Wright on, Science News, December 14, 1991, p. 387

Mathematics for Data Processing
William C. Brown Publishers, 1988

At-Home Play for Preschoolers (Photo), Offspring, 1988: No. 2, p. 9

Numerous reviews in *Science Books & Films* including:

The Fullness of Space by Gareth Wynn-Williams, publication pending

A Spacefaring Nation by Martin Collins and Sylvia Fries, publication pending

Colliding Galaxies: The Universe in Turmoil by Barry Parker, March/April, 1991, p. 38

The First Steps in Space Exploration by Films for the Humanities, Inc., Sept/Oct, 1990 p. 76

Flight to the Moon by Films for the Humanities Sept/Oct, 1990 p. 76

Computer - A Child's Play by Dharma Rajaraman Jan/Feb, 1990 p. 144

Mathematics by GPN, Jan/Feb, 1990 p. 154

Discovering Science on your Apple II by John Pellini, March/April, 1989 p. 243

Smart Apples: 31 Artificial Intelligence Experiments with the Apple II, by Delton Horn March/April, 1989 p. 9

Space Shuttle After Flight Reports, Vol. 5, by Ricon Enterprises, Sept/Oct, 1988, p. 59

Larousse Astronomy by Phillippe de la Cotaderiere, Sept/Oct, 1987, p. 13

Is Anybody Out There? by NOVA, Sept/Oct, 1987, p. 52

New Worlds: In Search of the Planets by Heather Couper and Nigel Henbest, April/May, 1987

The Basics: Wonder, Discovery and Experience (Photo), Offspring, 1987: No.1, p. 6

NASA Paid to Save Satellite, Detroit Free Press, 9/13/85

Russians Not First, Astronomy, Sept, 1983 p. 33

Starlight, a weekly column on astronomy and space exploration, Cross Lanes Record, 43 articles, 1975

Awe-Inspiring Sight, Charleston Daily Mail, July 16, 1975

Activities:

Society for Industrial and Applied Mathematics (SIAM)
Active member
Presentation given at ICIAM conference in 1991

National Air and Space Museum (NASM)
Regional Resource Person
Approximately 110 talks given on space exploration/aeronautics, 1981 - 1992

Michigan Association of Computer Users in Learning (MACUL)
Active member
Five presentations given, 1988 - 1992

Mathematical Association of America (Mi. Section) (MAA)
Active member
Two presentations given, 1990 - 1992

Science Books & Films
Active reviewer of science books/videos, 1986 - 1992

William C. Brown Publishers
Active reviewer of mathematics/computer texts, 1988 - 1992

Big Rapids Academic Boosters
Active member
Three Summer Academy classes taught, 1987 - 1992

Brookside Elementary Science Olympiad Team
Coach, 1991-92

Big Rapids Middle School Mathcounts Team
Coach, 1992-93

Honors:

National Honor Society, 1965 - 1966

Honors College, Michigan State University, 1968 - 1971

Member, Pi Mu Epsilon, 1968 - 1992

Member, Phi Beta Kappa, 1969 - 1992

Finalist, FSU Distinguished Teaching Award, 1984

Finalist, MAGB Distinguished Teaching Award, 1991 - 1992

Research and Grants:

"A Comparison of Russian and American Space Shuttle Programs", Summer, 1984, Houston, Texas

"Simulation of Variable Star Behavior", Sabbatical, Spring, 1988

"Using NASA Spacelink", FSU Mathematics Faculty Development, 1990, 1991 and 1992

"A Study of Second-Generation Tomato Plants from Space-exposed Seeds", FSU Research Grant, 1991

"Software and Development of a Manual for Karmarkar's Algorithm", FSU Faculty Development Grant, 1992

Special FSU Assignments:

Advisor, Pre-engineering students, 1981 - 1992

Taught Microcomputer Seminar for FSU faculty and staff, 1982 - 1984

Coordinator for Math 400, CSC 315, CSC 320 and CSC 328, 1982 - 1992

Mathematics Department Math 140 Committee, 1982 - 1988
Chairperson, 1982 - 1988

Mathematics Department Computer Committee, 1983 - 1992

Arts and Sciences Computer Committee, 1984 - 1992

Arts and Sciences Curriculum Committee, 1988 - 1990

Mathematics Department Faculty Search Committee, 1990 - 1991, Co-chairperson

Mathematics Department Faculty Travel Committee, 1991

Mentor for new faculty, 1987 - 1992

Arts and Sciences Faculty Support Committee, 1989 - 1992
Chairperson, 1991 - 1992
Secretary, 1990 - 1991

Arts and Sciences Liaison Committee, 1990 - 1992

Advised five Independent Study students in Math 499, the most recent being in 1992

RESUME
GLEN E. LOBO

OFFICE ADDRESS

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HOME ADDRESS

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Apt. #304A
Big Rapids, MI 49307
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EDUCATION

ABD	Mathematics	1990	U.W.-Milwaukee
M.S.	Mathematics	1987	U.W.-Milwaukee
M.Sc. (Honors)	Mathematics	1985	I.I.T. Kharagpur, India
B.Sc. (Honors)	Mathematics	1983	I.I.T. Kharagpur, India

Ph.D. Thesis (proposed) An Antenna-Radiation Boundary Value Problem for Maxwell's Equation.
M.Sc. Thesis Free Convection Flow Formation past a Vertical Plate

TEACHING EXPERIENCE

Graduate Teaching Assistant 1985 - 1991 U.W. - Milwaukee

Duties: Teaching with full responsibility courses in Basic Algebra, Trigonometry, Calculus for non-science majors and Calculus for science majors.

Conducting with full responsibility the Computer Laboratory component of Numerical Analysis, a junior level Mathematics course.

Assisting the Department at Late registration.

Assisting the Department in organizing Mathematics Colloquiums.

Assisting the Department Systems Manager in maintaining the Computer facilities in the Department.

Assistant Professor 1991 - Present Ferris State University

DUTIES AT FERRIS STATE UNIVERSITY FROM 1991 TO PRESENT

Teaching

Courses taught:

Fundamentals of Algebra (Math 110)
Intermediate Algebra (Math 115)
Trigonometry (Math 120)
Mathematical Analysis for Business (Math 122)
Advanced Algebra and Analytical Trigonometry (Math 130)
Calculus for the Life Sciences (Math 135)
Analytical Geometry & Calculus I, II, III (Math 220, Math 230, & Math 320)
Linear Algebra (Math 322)
Differential Equations (Math 330)
Operations Research (Math 360)
Advanced Calculus (Math 450)

Programming in BASIC (CPSC 150)
Computer Science I (CPSC 205)
Scientific Programming with Fortran (CPSC 244)

Committee Work, Advising, and Other Duties

Department

Coordinator	Applied Mathematics Program	1992 - present
	Actuarial Science Program	1992 - present
Chair	Applied Mathematics Committee	1992 - present
	Planning Committee	1994 - present
Member	Applied Mathematics Committee	1991 - present
	Planning Committee	1992 - present
	Education Assessment Committee	1993 - present
	Math 130, 220, 230, 320 Committee	1992 - present
	Math 135 Committee	1994 - present
	CPSC 244 Committee	1992 - present
Department Recording Secretary		1994 - 1995

College

Member	Planning Committee	1993- present

Advising

Advisor	1992 - 1993	Pre-Pharmacy

1993-1994 Applied Mathematics, Actuarial Science

Professional Activities

Member	Mathematical Association of America	1991 - present
	National Education Association	1991 - present
	Michigan Education Association	1991 - present

Conferences	1991 - 1992	College Mathematics: Teaching, Technology, and Applications Equity Within the Classroom: Graduating Minority Students
	1992 - 1993	Equity Within the Classroom: Graduating Minority Students Mathematical Association of America: Tri-Section Meeting
	1993 - 1994	A Day at Alverno College: Teaching and Assessing Student Abilities Calculus in Context: Introductory Workshop (Funded by the NSF)

I was invited to attend Calculus in Context: Training Workshop (Funded NSF) in June 1994, but I had to decline the invitation due to my teaching commitment at Ferris.

Recognized for suggestions made for the text:

QBASIC: With an Introduction to Visual Basic for Engineering, Mathematics, and the Sciences
- David I. Schneider
- Second Edition, Dellen Publications

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Educational Background: B.A. in Mathematics, 1963 -- Ball State University, Muncie, Indiana
M.A. in Mathematics, 1965 -- University of Kansas, Lawrence, Kansas
Ph. D. in Mathematics, 1977 -- University of Toledo, Toledo, Ohio

Dissertation Topic: Perturbation Theory, published in part as "Stability of Periodic Linear Systems by a Perturbation Method", Journal of Mathematical Analysis and Applications, Vol. 82, No. 1, Pp. 268-283, July, 1981

Teaching Experience: Ball State University, Instructor, 2 years, 1965-67
West Virginia Institute of Technology, 10 years 1970-1980
Central Michigan University, 1 year, 1980-81
Ferris State University, 1981-present, Professor of Mathematics

Past courses taught: Algebra and Trigonometry, Calculus and Analytic Geometry, Differential Equations, Probability and Statistics, Mathematical Statistics, Biostatistics, Modern Algebra, College Geometry, Numerical Analysis, Advanced Calculus (both applied and theoretical), Mathematical Modeling, Linear Algebra, Mathematics for Technology, Complex Variables, Fortran, Pascal, Basic, and Computer Graphics.

Consulting Experience: Statistical work for the Nursing Department at Ball State University. Statistical work for roof fall study done by Mining Engineering. Department at West Virginia Institute of Technology for OSHA. Statistical testing consultant for Standard Laboratories, Charleston, W. Va. Actuarial study for Human Resources at Ferris State University.

Recent Professional Activities:

Sabbatical Leave--Winter 1988-89 Studied Chaotic dynamics and gave a series of three open lectures, January and February 1989.
Attended a course in chaos in late February to May 1989 at University of Arizona given by Dr. Yves Pommeau.

Actuarial Exams--Passed at highest level (10)
Exam 100--Nov. 1990 (Calculus and Linear Algebra)
Exam 110--Feb. 1991 (Statistics)

Conferences--MAA/AMS National meetings in Atlanta, Jan. 1988
Louisville, Jan. 1990
(Short Course in Chaos) Providence, Aug. 1988
Baltimore, Jan. 1992
Cincinnati, Jan. 1994
MAA-Michigan Sections May, 1987-1990 and Notre Dame Tri-Section Meeting 1992

International Conference in Math. Educ. in Quebec, 1992

Other--Have been active in the reform calculus movement and in using technology in the teaching of mathematics. Responsibility for implementation of Actuarial Science program at Ferris State University. Sole advisor for Actuarial Science students. As coordinator of the Applied Mathematics Program 1990-93, I was responsible for the conversion of our programs to semesters. I have given a series of lectures to area high school mathematics classes in the subject of discrete dynamics.

References available on request.

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NOVEMBER 1990

The scale of grades runs from 0 to 10. Passing grades are 6 through 10. A grade of 0 does not mean that the candidate received no credit but that he/she had a very poor paper. Similarly, a grade of 10 indicates a very fine paper but not necessarily a perfect one.

ACTUARIAL EXAMINATION RESULTS

COURSE	GRADE
100	10

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ACTUARIAL EXAMINATION RESULTS

COURSE	GRADE
110	10

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