S.93-20

As amended by Senate 93/04/05

SIMON FRASER UNIVERSITY

Office of the Vice-President, Academic

MEMORANDUM

To:	Senate	**From:**	Dr. J. M. Munro Chair, Senate Committee on Academic Planning
Subject:	University College of the Fraser Valley/Simon Fraser University - B.Sc. Degree Proposal	**Date:**	March 17, 1993

Action undertaken by the Senate Committee on Undergraduate Studies and the Senate Committee on Academic Planning (SCAP 93 - 8) gives rise to the following motion:

Motion: "That Senate approve and recommend approval to the Board of Governors as set forth in S.93 - 20, the proposed University College of the Fraser Valley/Simon Fraser University B.Sc. Degree Proposal, *subject to adequate library and laboratory facilities being provided by the University College of the Fraser Valley to support the program as specified in departmental recommendations concerning the proposal.*"

NOTE: The detailed course proposal for SCIENCE 400-3 History and Philosophy of Science is not available at this time but will be presented to the SFU Senate for approval at a later date, prior to implementation.

SIMON FRASER UNIVERSITY
MEMORANDUM

To: R. Heath
Secretary to SCUS

From: C.H.W. Jones, Dean
Faculty of Science

Subject: **UCFV/SFU**
B.Sc. Degree Proposal

Date: March 9, 1993

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On March 8 1993 the Faculty of Science approved the proposal for the establishment of a University College of the Fraser Valley/SFU B.Sc. degree programme (double minors degree). I am now forwarding this proposal to SCUS for your consideration.

This proposal follows on from the agreement arrived at between UCFV and SFU for the University College to offer SFU B.A. and B.Sc. degree programmes. The B.Sc. degree proposal has been developed by Dr. E.J. Wells (Department of Chemistry) as Director of Science Programme Liaison with the University College, in collaboration with the Science faculty at UCFV. Dr. Wells has also worked closely with the Science Departments here at SFU and in particular with Dr. R.W. Mathewes (Biosciences), B. Alspach (Mathematics & Statistics) and R.F. Frindt (Physics), who were assigned by their departments to coordinate the programme development in each of their disciplines.

Each component of the B.Sc. (double minors) proposal has been approved by the appropriate Departmental Undergraduate Curriculum Committee and those considerations included the approval of each of the specific, new 300 and 400 level courses proposed by UCFV.

The B.Sc. degree programme comprises two minors (and their lower-level pre-requisites) to be selected from:

Biology
Chemistry
Physics
Mathematics or Mathematics with Statistics.

The Faculty of science Curriculum Committee Committee has considered and approved the full proposal as has the faculty of Science as a whole.

The motion passed at the Faculty meeting read:

"To approve the University College of the Fraser Valley B.Sc. proposed programmes as outlined in Paper FSC 3-93 subject to adequate library and laboratory facilities being provided by the University College of the Fraser Valley to support the programme as specified in Department recommendations concerning the proposal"

and we would now propose that SCUS give appropriate consideration to this proposal.

C.H.W. Jones.

C.H.W. Jones

CHWJ:rh:Encl.

c. E.J. Wells, Director,
Science Programme Liaison

R.C. Brooke, Chair
Faculty of Science Undergraduate Curriculum Committee

17 March 1993

A PROPOSAL FOR THE UNIVERSITY COLLEGE OF THE FRASER VALLEY TO OFFER A B.Sc.: DOUBLE MINORS

1. INTRODUCTION

The University College of the Fraser Valley (UCFV) B.Sc. program aims to provide a broad general education with specialization in two areas selected from the natural sciences and mathematics. The specific requirements of the degree include courses to the level of minors in a minimum of two disciplines. Initially the list of discipline options will include: Biology, Chemistry, Mathematics, Mathematics with Statistics and Physics. Over the course of the next decade it is anticipated that the list of minors areas will expand to include additional options. Similarly, plans to create major options will be given serious consideration as the program becomes more established. Future plans also include the mixing of Arts and Science minors options so that students could complete a B.A. or B.Sc. with double minor in an arts discipline and a science discipline (i.e., a B.A. in Chemistry and Economics or a B.Sc. in Psychology and Biology).

The requirements for a minor will include a prescribed set of core and prerequisite courses at the lower level and a minimum of five courses in each minor at the upper level. An additional requirement at the upper level will include a fourth year course in the history and philosophy of science (Science 400). This course is considered as a capstone experience for the students and will help to establish the unique nature of the UCFV program.

2. PROGRAM OBJECTIVES

a. Student Learning Objectives: After completing the four year science degree, the successful students should be able to:

1. think critically;

2. demonstrate a scientific literacy by discussing the unique nature of science - its development, history and philosophy;

3. better understand the important role science has played and will continue to play in the development of a healthy, free and vibrant economy;

4. enumerate the contributions science has made to our society;

5. make more informed decisions about the important role science will play in the future of Canada;

6. use their acquired scientific skills in a manner which makes them successful and valuable employees;

7. attain admission to graduate schools by demonstrating the requisite knowledge and skills needed by these schools.

b. Instructor Objectives: The science instructors of the University College of the Fraser Valley will strive to:

1. provide the highest quality of instruction possible;

2. treat all students, regardless of their gender, race, religion, colour, or creed, with attention and dedication;

3. develop techniques which will permit student participation in the decisions which affect their learning environment;

4. provide an enriched scientific learning environment through extra curricular and science related activities, i.e., seminars, films, social gatherings, field trips, etc.;

5. search out and experiment with alternate forms of instructional styles;

6. provide the students with examples of academic courage and intellectual leadership;

7. ensure that the educational services being provided to the student are current, germane, and of the highest calibre.

3. PROGRAM NAME AND DEGREE TO BE AWARDED

Bachelor of Science: Double Minors

4. PROSPECTIVE AREAS OF EMPLOYMENT FOR STUDENTS COMPLETING THE PROGRAM

On completion of the B.Sc. double minors degree students will have a high quality foundation in science allowing them to pursue a wide variety of careers in business and industry or to pursue further educational opportunities. Students holding a B.Sc. degree are well placed to compete for entry level positions such as lab technicians or managerial trainees in firms requiring a background knowledge in the sciences. The B.Sc. double minors degree in two teachable subjects is considered excellent preparation for students who intend to pursue professional qualifications for elementary and secondary teaching. It is also very useful background for students seeking entry into one or other of the professional schools that require a good grounding in science as a prerequisite. Students wishing to continue their studies through to the graduate level with a double minor would, in most cases, be required to complete additional courses at the undergraduate level as part of a qualifying year or as part of their graduate program.

5. IMPLEMENTATION

The program will be implemented over the next three academic years (93/94 - 94/95 - 95/96). It is anticipated that during the initial stages of implementation the demand for third and fourth year courses will be low, therefore all of the planned third and fourth year courses will not be offered until such time as enrolments warrant, possibly by the 95/96 academic year. The minimum number of required third year courses for each minor will be offered in the 93/94 academic year. The same will be the case for fourth year course offerings in the 94/95 academic year.

Predicted Full Time Student Equivalents and Instructors:

In order to establish a viable and successful degree program, the enrolments in first year courses must be allowed to increase in the preliminary year 1992/93. The transformation from a two year college to a four year university college will create an increase in the demand for our first year courses, and when the 17.7% Grade 12 growth in the UCFV catchment area is also considered a significant growth in our first year program seems likely. Also, there will be an increased demand for second year courses, necessitating offering additional sections of second year, especially in biology and chemistry.

TOTAL NEW INSTRUCTORS REQUIRED:

	93/94	94/95
Biology	1	1
Chemistry	1	1
Physics	1	0
Mathematics	2	1
Computing Science	1	1

New lab assistant positions will also be required when new lab sections are offered

6. ADMISSION TO THE PROGRAM

Students are not officially admitted to the B.Sc. program until they have accumulated 45 credits which are transferable to SFU, and have a minimum overall grade point average of 2.0 on the transferable courses. The 45 credits of courses need not be in courses required for the B.Sc. degree.

All of the lower levels courses offered as part of the B.Sc. program are transferable to all B.C. universities. Upper levels courses may in some cases be transferred to a university. Students should consult with the university of their choice concerning possible transfer credit of UCFV upper levels courses.

7. ACADEMIC PERFORMANCE STANDARDS

To qualify for the B.Sc. degree a student must maintain a cumulative grade point average of 2.0. In addition, a cumulative grade point average of 2.0 must be maintained in the upper levels in each minor subject.

8. FACILITIES

Laboratory resources:
Biology:
2 Labs in Abbotsford, @ 24 students.
1 Small greenhouse in Abbotsford.
1 Animal room in Abbotsford
1 Prep room in Abbotsford.
1 Student project room in Abbotsford.
1 Lab in Chilliwack (shared with Agriculture), @ 24 students.
2 large greenhouses in Chilliwack (mostly used by Agriculture).
1 Prep room in Chilliwack.

Chemistry:
2 Labs in Abbotsford, @ 24 students.
1 Chemical storage room in Abbotsford.
1 Prep room in Abbotsford.
1 Student project room in Abbotsford.
1 Lab in Chilliwack, @ 24 students.
1 Prep room in Chilliwack.

Physics:
1 Lab in Abbotsford, @ 24 students
1 Prep room in Abbotsford.
1 Student project room in Abbotsford.
1 Lab in Chilliwack, @ 24 students.

Future expansion is in the planning stage. Plans are for 1 additional lab in Biology, Physics, Chemistry and Computing Science.

Mathematics:
1 Math Centre in Abbotsford with one planned for Chilliwack

Computing Science:
1 lab in each of Abbotsford and Chilliwack with expansion in future plans

9. ADMINISTRATIVE SUPPORT

In the next few years the following Department of Natural Sciences changes are likely to be needed:

a. The growth of the enrolments in the individual disciplines will necessitate the appointment of Department Heads in biology, chemistry, and physics.

b. A Dean (or Associate Dean) of Science will be required to coordinate the Science Department.

c. A lab supervisor will be required or maybe a lab coordinator for each of the disciplines.

d. A Program Advisor and Coordinator will be required to counsel and advise students as to the requirements for graduation.

10. UCFV FACULTY MEMBERS AND SUPPORT STAFF

Faculty qualifications:

The minimum academic qualification will remain a M.Sc. degree, but a Ph.D. degree is preferred. However, a M.Sc. degree should qualify any faculty member to teach any of the courses offered, first to fourth year inclusive, that are within their area of expertise. New faculty will be selected in consultation with SFU; demonstrated superior teaching skills will be preferred over degrees and research experience.

The minimum qualifications for the Faculty Assistants (lab assistants) will be a B.Sc. degree in their speciality, or comparable training from an institution such as B.C.I.T. It is anticipated that some of the fourth year labs will require lab assistants with advanced degrees, or comparable training and experience.

The following is a list of the current faculty and their qualifications:

Biology instructors:
Ernest Kroeker, Ph.D., Queens University
Barbara Moon, B.Sc., UBC, Ph.D (education) in progress SFU.
Henry Speer, Ph.D., Princeton University.
Terry Starr, Ph.D., UBC (one year appointment).
Susan Minaker, M.Sc., Univ Alberta (one year leave replacement appointment).

Biology lab assistants:
Gwen Bollerup, M.Sc., SFU (biol/chem lab assistant).
Brad Whittaker, B.Sc., UBC, M.Sc in progress U. Victoria
Leslie Wood, M.Sc., SFU.
James Salahub, M.Sc., Univ of Alberta (biol/chem lab assistant)

Chemistry instructors:
Nigel Dance, Ph.D., Aston in Birmingham, Great Britain.
Arthur Last, Ph.D., Univ. of Essex, Great Britain.
Lillian Martin, Ph.D., SFU
Peter Slade, M.Sc., SFU

Chemistry lab assistants:
Gwen Bollerup, M.Sc., SFU (biol/chem lab assistant).
Gordon von Hollen, B.SC., Alberta
Brad Whittaker, B.Sc., UBC, M.Sc in progress U. Victoria.

Physics instructors:
Tim Cooper, Ph.D., Univ. of Alberta.
George McGuire, M.Sc., Portland
Robert Woodside, Ph.D., McMaster University.

Physics lab assistants:
Marshal Langtry, B.Sc., UBC

Math instructors:
Velma Alford, B.A., Univ. of Manitoba.
Jane Cannon, MSTM, Univ of Santa Clara.
Barry Garner, Ph.D, Nottingham University, U.K.
Carollyne Guidera, M.Sc., SFU.
Susan Milner, M.Sc., McMaster.
Linda Riva, M.Math, Waterloo.
Gregg Schlitt, Ph.D, McMaster

Computing Science instructors:
Gregg Buck, B.Comm., Sask.
Elaigh Guidera, Ph.D., SFU
Duncan Jefferies, M.Sc., UBC
Patrick O'Brien, B.Comm., Windsor
Wayne Welsh, Ph.D., UBC

Computing Science lab assistants:
Ben Ling, Electronics DIP, B.C.I.T.

11. PROGRAM STRUCTURE

To be eligible for a B.Sc. a student must satisfactorily complete:

- a minimum of 120 credits of which at least 60 must be completed at University College of the Fraser Valley.
- a minimum of 30 upper levels credits (numbered 300 and above) as specified by the double minors.
- additional credits to total 45 credits of upper levels, including Science 400.
- a minimum of 12 credits taken in non-science courses including at least 6 credits in English.

Requirements for a minor:
The specific course requirements for a minor vary in each discipline and are listed below.

General requirements:

All students in the program must take the following core courses:

- Math 111-4 Calculus I
- Math 112-4 Calculus II
- English 105-3 The Reading and Writing of Prose and one additional English course numbered above 105.
- Science 400-3 History and Philosophy of Science.**
- At least one statistics course appropriate to the selected minors (Physics minor is excepted).
- At least two computing courses appropriate to the selected minors.
- Two minors selected from the following, each of which requires a minimum of five upper levels courses:

  Biology
  Chemistry
  Physics
  Mathematics or Mathematics with Statistics

** The detailed course proposal for SCIENCE 400-3 History and Philosophy of Science is not available at this time but will be presented to the SFU Senate for approval at a later date, prior to implementation.

12. REQUIREMENTS FOR EACH MINOR

A. REQUIREMENTS FOR A BIOLOGY MINOR (* Denotes new course)

FIRST YEAR COURSES:

At least one of the following two-semester sequences:
Chemistry 111-4 and 112-4 Principles of Chemistry I & II
or
Physics 111-4 and 112-4 Mechanics and Sound/Electricity, Magnetism, and Waves

Plus the following required courses:
Biology 111-4 Introductory Biology I
Biology 112-4 Introductory Biology II
Math 111-4 Calculus I
Math 112-4 Calculus II

and at least one statistics course selected from the following:
Math 106-3 Statistics I (for biology minors only)
Math 270-4 Introduction to Probability and Statistics
Math 302-4 Analysis of Experimental and Observational Data

and at least two approved computing courses

and
English 105-3 The Reading and Writing of Prose
and one additional English course numbered above 105.

SECOND YEAR COURSES:
The following required courses:

Biology 201-4 Cell Biology
Prerequisites: Biol 111/112 Introductory Biology
Corequisite: Chem 211 Organic Chemistry

Biology 202-4 Cell Biology (with labs)
Prerequisites: Biol 201 Cell Biology
Corequisite: Chem 212 Organic Chemistry

Biology 210-4 Introductory Ecology
Prerequisites: Biol 111/112 Introductory Biology

Biology 220-4 Introductory Genetics (with labs)
Prerequisites: Biol 111/112

UPPER LEVELS COURSES:
The following required course:
Science 400-3 The History and Philosophy of Science

And a minimum of five courses selected from the following:

THIRD YEAR COURSES:
*Biology 301-4 Anatomy and Physiology of Animals I (with labs)
Prerequisites: Biol 111/112

*Biology 302-4 Anatomy and Physiology of Animals II (with labs)
Prerequisites: Biol 301

*Biology 303-4 Anatomy and Physiology of Plants I (with labs)
Prerequisites: Biol 111/112

*Biology 304-4 Anatomy and Physiology of Plants II (with labs)
Prerequisites: Biol 303

FOURTH YEAR COURSES:

*Biology 401-4 Molecular Biology of the Cell I
Prerequisites: Biol 201/202 Cell Biology, Biol 220 Genetics
Biol 305 Biological Chemistry

*Biology 402-4 Molecular Biology of the Cell II
Prerequisites: Biol 401

B. **REQUIREMENTS FOR A CHEMISTRY MINOR** (*Denotes new courses)

FIRST YEAR COURSES:

The following required courses:
Chemistry 111-4 Principles of Chemistry I
Chemistry 112-4 Principles of Chemistry II
Physics 111-4 Mechanics and Sound
Math 111-4 Calculus I
Math 112-4 Calculus II

Plus one of the following selections:
Biology 111-4 and 112-4 Introductory Biology I & II
or
Physics 112-4 Electricity, Magnetism, and Waves

and at least one statistics course selected from the following:
Math 270-4 Introduction to Probability and Statistics
Math 302-4 Analysis of Experimental and Observational Data

and at least two approved computing courses

and
English 105-3 The Reading and Writing of Prose
and one additional English course numbered above 105.

SECOND YEAR COURSES:

The following required courses:
Chemistry 211-4 Introductory Organic Chemistry I
Prerequisites: Chem 111/112 or 101/102 with B

Chemistry 212-4 Introductory Organic Chemistry II
Prerequisites: Chem 211

Chemistry 221-4 Inorganic Chemistry I
Prerequisites: Chem 111/112 or 101/102 with B

Chemistry 222-4 Physical Chemistry I
Prerequisites: Chem 221, Math 211

Math 270-4 Introduction to Probability and Statistics

UPPER LEVELS COURSES:

The following required course:
Science 400-3 The History and Philosophy of Science

And a minimum of five courses selected from the following:

THIRD YEAR COURSES:

*Chemistry 311-4 Intermediate Organic Chemistry I
Prerequisites: Chem 211/212 Introductory Organic Chemistry

*Chemistry 312-4 Intermediate Organic Chemistry II
Prerequisites: Chem 311

*Chemistry 321-4 Intermediate Inorganic Chemistry
Prerequisites: Chem 221

*Chemistry 322-4 Intermediate Physical Chemistry
Prerequisites: Chem 222, Math 211, Phys 111, Phys 112

FOURTH YEAR COURSES:

*Chemistry 421-4 Advanced Inorganic Chemistry
Prerequisites: Chem 321 Intermediate Inorganic

*Chemistry 441-4 Analytical Chemistry/Applied Molecular Spectroscopy
Prerequisites: Any 3 of Chem 211, 212, 221, 222

C. REQUIREMENTS FOR A PHYSICS MINOR (*Denotes new courses)

FIRST YEAR COURSES:

The following required courses:
Physics 111-4 Mechanics and Sound
Physics 112-4 Electricity, Magnetism, and Waves
Math 111-4 Calculus I
Math 112-4 Calculus II

Plus at least one of the following two-semester sequences:
Biology 111-4 and 112-4 Introductory Biology I & II
or
Chemistry 111-4 and 112-4 Principles of Chemistry I and II

and two approved computing courses

and
English 105-3 The Reading and Writing of Prose
and one additional English course numbered above 105.

SECOND YEAR COURSES:

Physics 221-4 Vector Mechanics
Prerequisites: Physics 111/112
Corequisites: Math 211 and 221

Physics 222-4 Electricity, Magnetism, and Circuits
Prerequisites: Physics 221
Corequisites: Math 212/213

Physics 231-3 Introductory Thermodynamics
Prerequisites: Physics 111 and Math 111

Physics 252-3 Special Relativity/Quantum Physics
Prerequisites: Physics 111/112 and Math 211
Corequisites: Math 213

All four of the following math courses must be taken to complete the minor:
Math 211-3 Calculus III
Math 212-3 Calculus IV
Math 213-3 Differential Equations
Math 221-3 Linear Algebra

UPPER LEVELS COURSES:

The following required course:
Science 400-3 The History and Philosophy of Science

And a minimum of five courses selected from the following:

THIRD YEAR COURSES:

Note: Five of the courses listed below are to be completed in the third and fourth years. Not all courses will be offered at any given time.

*Physics 311-3 Statistical Physics
Prerequisites: Physics 231

*Physics 321-3 Advanced Mechanics
Prerequisites: Physics 221.

*Physics 322-3 Advanced Electricity and Magnatism (no lab)
Prerequisites: Physics 222

*Physics 351-3 Quantum Mechanics
Prerequisites: Physics 252
Corequisites: Physics 381

*Physics 381-3 Mathematical Physics
Prerequisites: Physics 111/112, Math 211,212,213,221

*Physics 382-4 Modern Physics Lab (two 3 hour labs).
Prerequisites: Physics 221/222,252
Corequisites: Physics 332-3

D. REQUIREMENTS FOR A MATH MINOR (*Denotes new courses)

FIRST YEAR COURSES:

At least one of the following two semester courses:
Chemistry 111-4 and 112-4 Principles of Chemistry I & II
or
Physics 111-4 and 112-4 Mechanics and Sound/Electricity, Magnetism, and Waves
or
Biology 111-4 and 112-4 Introductory Biology I & II

Plus the following required courses:
Math 111-4 Calculus I
Math 112-4 Calculus II

and at least two approved computing courses

and
English 105-3 The Reading and Writing of Prose
and one additional English course numbered above 105.

SECOND YEAR:

The following required courses:
Math 211-3 Multivariable Calculus
Math 221-3 Linear Algebra
Math 270-4 Introduction to Probability and Statistics (Calculus based Stats)

And one of:
Math 212-3 Calculus IV (Vector Calculus)
Math 213-3 Introduction to Ordinary Differential Equations
Math 214-3 Introduction to Analysis
Math 243-3 Discrete Mathematics

Note: It is recommended that students take the course Math 302-4 Analysis of Observational and Experimental Data; in order to increase the choice of upper level courses available to the student, Math 302 should be taken in the second or third years.

UPPER LEVELS COURSES:

The following required course:
Science 400-3 The History and Philosophy of Science

And a minimum of five courses selected from the following:
THIRD AND FOURTH YEAR:
*Math 308-3 Linear Programming
*Math 316-3 Numerical Analysis
*Math 320-3 Advanced Calculus of One Variable
*Math 322-3 Complex Variables
*Math 330-4 Design of Experiments
*Math 343-3 Applied Discrete Mathematics
*Math 350-4 Survey Sampling
*Math 370-4 Methods of Multivariate Statistics
*Math 390-4 Time series & Forecasting
*Math 402-4 Generalized Linear Models and Survival Analysis
*Math 439-3 Modern Algebra

(Not all courses will be available every year, but the department will offer sufficient courses over a two year cycle for students to complete the requirements for a minor in two years.)

E. REQUIREMENTS FOR A MATH MINOR WITH STATISTICS OPTION

(*Denotes new courses)

FIRST YEAR COURSES:

At least one of the following two-semester sequence courses:
Math 111-4 Calculus I and Math 112-4 Calculus II
or
Math 113-4 Differential Calculus and Math 114-4 Integral Calculus and Linear Methods

and
English 105-3 The Reading and Writing of Prose,
and one additional English course numbered above 105

and at least one of the following two-semester sequences:
Biology 111-4 and 112-4 Introductory Biology I & II
or
Chemistry 111-4 and 112-4 Principles of Chemistry I & II
or
Physics 111-4 and 112-4 Mechanics and Sound/Electricity, Magnetism & Waves

and at least two approved computing courses

SECOND YEAR COURSES:

The following required courses:
Math 211-3 Calculus III (Multivariable Calculus)
Math 221-3 Linear Algebra
Math 270-4 Introduction to Probability & Statistics
Math 302-4 Analysis of Observational and Experimental Data

UPPER LEVELS COURSES:
Science 400-3 History and Philosophy of Science

And a minimum of five courses selected from the following:

THIRD and FOURTH YEAR:

*Math 308-3 Linear Programming
*Math 330-4 Design of Experiments
*Math 350-4 Survey Sampling
*Math 370-4 Methods of Multivariate Statistics
*Math 390-4 Time series & Forecasting
*Math 402-4 Generalized Linear Models and Survival Analysis

(Not all courses will be available every year, but the department will offer sufficient courses over a two year cycle for students to complete the requirements for a minor in two years.)

13. ANTICIPATED UPPER LEVELS COURSE OFFERINGS FOR 1993/94

Fall 1993:

Biol 303-4 Anatomy and Physiology of Plants I
Prerequisites: Biol 111/112

Chem 311-4 Intermediate Organic I
Prerequisites: Chem 211/212 Introductory Organic Chemistry

Phys 381-3 Mathematical Physics

Phys 321-3 Advanced Mechanics (may be offered)

Math 214-3 Introduction to Analysis

Math 270-4 Introduction to Probability and Statistics

Math 308-3 Linear Programming

Winter 1994:

Biol 304-4 Anatomy and Physiology of Plants II
Prerequisites: Biol 303

Chem 312-4 Intermediate Organic II
Prerequisites: Chem 311

Phys 351-3 Quantum Mechanics

Phys 322-3 Advanced Electricity and Magnetism (may be offered)

Math 322-3 Complex Variables

For **Math with Statistics option**

Math 302-4 Analysis of Observational and Experimental Data

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES **DATE:** Fall 1992

Biology 301	Anatomy and Physiology of Animals - I	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The course deals with physiological and anatomical adaptations of select invertebrate animals with an emphasis on principles of functional morphology. Life histories, feeding and nutrition, respiration, excretion, reproduction and development will be studied. This course includes one field trip.

COURSE PREREQUISITES: Biology 111/112

COURSE COREQUISITES: none

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**60 hrs**	**Student Directed Learning**		**hrs**
	Laboratory	**33 hrs**			
	Seminar	**hrs**	**Other - specify:**		
	Field Experience	**12 hrs**			**hrs**
			TOTAL	**105**	**HRS**

UCFV CREDIT TRANSFER	[X]	**UCFV CREDIT NON-TRANSFER**	[ ]	**NON-CREDIT**	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	To be determined
SFU	For UCFV - SFU B.Sc. in General Science, double minors
UVIC	To be determined
Other	

Ernest M. Kroeker, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

B.1

Biology 301
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:
none	Biology 302, Anatomy & Physiology of Animals II

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: *Living Invertebrates*, V. Pearse, J. Pearse, M. Buchsbaum and R. Buchsbaum

Lab manual: *The Invertebrates: Form and Function*, I. and V. Sherman

OBJECTIVES:

To provide a basic understanding of the anatomy and physiology of the invertebrates. Students should gain an appreciation for invertebrate diversity as well as structure and function relationships within specific body plans.

METHODS:

Lecture, demonstration, small group practice, discussion, AV materials, use of models and charts, and lab exercises with at least one field trip.

STUDENT EVALUATION PROCEDURE:

Midterm lecture	25%
Midterm lab	10%
Final lecture	30%
Final lab	20%
Student project	15%

Biology 301
NAME & NUMBER OF COURSE

COURSE CONTENT:

The course will deal with functional anatomy and physiology of the following groups: Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Mollusca, Annelida, Arthropoda and Echinodermata. Relevant topics including basic body plan, feeding and digestion, reproduction and development, locomotion, respiration, hormones, and excretion will be discussed.

INSTRUCTOR: TBA

LAB INSTRUCTOR: TBA

Biology 301
NAME & NUMBER OF COURSE

LABORATORY EXPERIMENTS:

1. Protozoa
2. Porifera; body plan, skeleton and reproduction
3. Cnidaria; polyp vs medusa, digestion, circulation, locomotion, skeleton and reproduction
4. Platyhelminthes; anatomy, neuromuscular system, digestion, excretion and reproduction
5. Aschelminthes; anatomy, cuticle, locomotion, digestion, excretion and reproduction
6. Annelida; anatomy, locomotion, digestion, circulation and respiration, excretion, nervous system
7. Mollusca; anatomy, respiration, excretion, digestion, circulation, neuromuscular system, reproduction and development
8. Echinodermata; anatomy, respiration, digestion, circulation, nervous system, reproduction and development
9. Protochordataes; anatomy, digestion, neuromuscular system, excretion, reproduction and development

SUPPORTING LAB EQUIPMENT AVAILABLE:

Basic lab equipment; microscopes, microscope slide collection, preserved specimens and models, incubators, centrifuges, waterbaths, glassware, pH meters, oxygen electrodes, and salt water tanks are available.

SUPPORTING LAB EQUIPMENT TO BE PURCHASED:

Special order equipment to be determined.

LIBRARY RESOURCES:

BOOKS: *Invertebrate Zoology*, Barnes
The Invertebrates vol. I-VI, Hyman
The Principles of Insect Physiology, Wigglesworth
Limited collection on specific groups;
Protozoan, Insects, Echinoderms, Molluscs, Nematodes, Arthropoda

JOURNALS: Archives of Insect Biochemistry and Physiology
Journal of Experimental Biology
general physiology journals listed for Biology 302

B4

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: Fall 1992

Biology 302	Anatomy and Physiology of Animals - II	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

Vertebrate organisms will be studied with an emphasis on basic physiological concepts and structure/function relationships within the vertebrate body plan.

COURSE PREREQUISITES: Biology 111/112, Biology 201/202

COURSE COREQUISITES: none

HOURS PER TERM FOR EACH STUDENT					
	Lecture	60	hrs	Student Directed Learning	hrs
	Laboratory	45	hrs	Other - specify:	
	Seminar		hrs	_____	hrs
	Field Experience		hrs	TOTAL	105 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	To be determined
SFU	For UCFV - SFU B.Sc. in General Science, double minors
UVIC	To be determined
Other	

Ernest M. Kroeker, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

B.5

Biology 302
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:
none	Biology 301, Anatomy & Physiology of Animals I

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXTS: *Animal Physiology*, Eckert, Randall and Augustine
plus selected readings for basic histology and reproductive physiology

Lab manual: an in-house manual will be developed

OBJECTIVES:

To provide a basic understanding of physiological concepts and the vertebrate body plan. Students should gain an appreciation for structure and function relationships within specific body plans.

METHODS:

Lecture, demonstration, small group practice, discussion, AV materials, use of models and charts, and lab exercises.

STUDENT EVALUATION PROCEDURE:

Midterm lecture	25%
Final lecture	35%
Final lab	25%
Student project	15%

Biology 302
NAME & NUMBER OF COURSE

COURSE CONTENT:

Topics will include:

- basic physiological concepts
- basic history
- diffusion, colligative properties, osmosis, Donnan Equil.
- membranes
- action potentials and synaptic transmission
- sensory mechanisms
- chemical messengers and regulators
- muscles and movement
- osmoregulation and excretion
- circulation
- gas exchange
- feeding and digestion
- reproduction

INSTRUCTOR: TBA

LAB INSTRUCTOR: TBA

Biology 302
NAME & NUMBER OF COURSE

LABORATORY EXPERIMENTS:

1. basic histology (2 labs)
2. nerve action potentials
3. skeletal muscle function
4. smooth muscle function
5. gas exchange
6. sensory systems
7. excretion
8. reproduction

SUPPORTING LAB EQUIPMENT AVAILABLE:

Basic lab equipment; microscopes, microscope slide collection, preserved specimens and models, incubators, centrifuges, waterbaths, glassware, pH meters, oxygen electrodes, and salt water tanks are available.

SUPPORTING LAB EQUIPMENT TO BE PURCHASED:

Equipment for nerve and muscle function labs will be required.

LIBRARY RESOURCES:

BOOKS: *The Life of Vertebrates*, Young
Functional Anatomy of Vertebrates, Walker
An Atlas of Histology, Freeman and Bracegirdle
appropriate supplement for reproductive physiology still being sought

JOURNALS: Annual Review of Physiology
Physiological Zoology
Environmental Physiology
Journal of Comparative Physiology

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: Fall 1992

Biology 303	Anatomy and Physiology of Plants- I	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

A survey of the nonvascular plants. The course will cover the fungi, algae and bryophytes. The life history, diversity, nutrition, ecology, genetics and phylogeny of the various nonvascular plant groups will be covered. Laboratory exercises will be used to emphasize aspects of the course.

COURSE PREREQUISITES: Biology 111/112, Introductory Biology

COURSE COREQUISITES: none

HOURS PER TERM FOR EACH STUDENT	Lecture	60 hrs	Student Directed Learning		hrs
	Laboratory	45 hrs	Other - specify:		
	Seminar	hrs			hrs
	Field Experience	hrs	TOTAL	105	HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	To be determined
SFU	For UCFV - SFU B.Sc. in General Science, double minors
UVIC	To be determined
Other	

Henry L. Speer, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

B.9

Biology 303
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:
Biology 404, Plant Biology	Biology 304, Anatomy & Physiology of Plants - II Biology 404, Plant Physiology

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:

NOTE: We are planning to hire a plant physiologist in the spring of 1993. This person will have responsibility for the development and teaching of this course. The selection of a particular text will be left to the discretion of this person.

OBJECTIVES:

This course will provide the student with a basic understanding of the anatomy, physiology, genetics, and phylogeny of the Phyla commonly referred to as the nonvascular plants.

METHODS:

Lecture, demonstration, small group practice, discussion, AV materials, use of models and charts, and lab exercises.

STUDENT EVALUATION PROCEDURE:

Midterm exam	30%
Lab assignments	10%
Lab project	10%
Lecture final exam	30%
Lab final exam	20%

COURSE CONTENT:

The Fungi: structure and function, diversity, growth and nutrition, genetics, phylogeny, ecology of: Oomycota, Zygomycota, Deuteromycota, Ascomycota, Basidomycota, Lichens.

The Algae: structure and function, diversity, growth and nutrition, genetics, phylogeny, ecology of: Cyanobacter, Chlorophyta, Chrysophyta, Pyrrophyta, Euglenophyta, Rhodophyta.

Bryophytes: structure and function, diversity, growth and nutrition, genetics, phylogeny, ecology of: Hepaticopsida, Hornworts, Muscopsida.

INSTRUCTOR: A new instructor (Ph.D.) will be hired in the spring of 1993 to develop and teach this course.

LAB INSTRUCTOR: New lab instructors or lab assistants will be hired in the spring of 1993. We contemplate hiring persons with the competence to do the labs in this course.

LABORATORY EXPERIMENTS:

1. Identification of fresh water algae
2. Identification of marine algae
3. Identification of aquatic fungi
4. Identification of terrestrial fungi
5. Identification of the Bryophytes
6. A study of the ecology of a fresh water stream:
   a) The physical aspects: temperature, pH, flow rate, turbidity, etc.
   b) Water chemistry and BOD
   c) Periphyton distribution and characteristics
   d) streams as echosystems
7. An investigation of the nutritional requirements of some unicellular algae using defined medium
8. The effects of temperature, light intensity, wavelength, and inhibitors on the rate of photosynthesis in unicellular algae
9. The isolation, separation, and characterization of the photosynthetic pigments of algae

UPPORTING LAB EQUIPMENT AVAILABLE:

Basic lab equipment such as incubators, centrifuges, waterbaths, glassware, pH meters, oxygen electrodes, column and TLC chromatographic apparatus, gel electrophoresis apparatus, tissue homogenizers, and balances are available in our present inventory.

PPORTING LAB EQUIPMENT TO BE PURCHASED:

Special needs equipment for the labs in this course will have to be ordered and will be determined by the instructor teaching the course.

LIBRARY RESOURCES:

BOOKS: *A Biology of the Algae*, Philip Sez
Chemistry and Biochemistry of Plant Pigments, T.W. Goodwin
Plant Physiology, R.G.S. Bidwell
Biology of Plants, Raven, Evert, and Curtis
Botany: an Ecological Approach, Jensen and Salisbury

JOURNALS: Annual Review of Plant Physiology
Canadian Journal of Botany
Plant Physiology
Plant Biochemistry

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES **DATE:** Fall 1992

Biology 304	Anatomy and Physiology of Plants- II	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

A survey of the vascular plants. The course will cover the Psilophyta, Lycophyta, Sphenophyta, Pterophyta, Gymnosperms, and Angiosperms. The life history, diversity, nutrition, ecology, genetics and phylogeny of the various vascular plant groups will be covered. Laboratory exercises will be used to emphasize aspects of the course.

COURSE PREREQUISITES: Biology 303, Anatomy and Physiology of Plants - I

COURSE COREQUISITES: none

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**60 hrs**	**Student Directed Learning**		**hrs**
	Laboratory	**45 hrs**			
	Seminar	**hrs**	**Other - specify:**		
	Field Experience	**hrs**			**hrs**
			TOTAL	**105**	**HRS**

UCFV CREDIT TRANSFER [X] **UCFV CREDIT NON-TRANSFER** [ ] **NON-CREDIT** [ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC To be determined

SFU For UCFV - SFU B.Sc. in General Science, double minors

UVIC To be determined

Other

Henry L. Speer, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Biology 304
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:
Biology 404, Plant Biology	Biology 303, Anatomy & Physiology of Plants - I Biology 404, Plant Physiology

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:

NOTE: We are planning to hire a plant physiologist in the spring of 1993. This person will have responsibility for the development and teaching of this course. The selection of a particular text will be left to the discretion of this person.

OBJECTIVES:

This course will provide the student with a basic understanding of the anatomy, physiology, genetics, and phylogeny of the Phyla commonly referred to as the vascular plants.

METHODS:

Lecture, demonstration, small group practice, discussion, AV materials, use of models and charts, and lab exercises.

STUDENT EVALUATION PROCEDURE:

Midterm exam	30%
Lab assignments	10%
Lab project	10%
Lecture final exam	30%
Lab final exam	20%

Biology 304
NAME & NUMBER OF COURSE

COURSE CONTENT:

The structure and function, diversity, growth and nutrition, genetics, phylogeny, and the ecology of the following major vascular plant groups will be covered:

Psilophyta, Lycophyta, Sphenophyta, Pterophyta, Gymnosperms, Angiosperms

Lectures and laboratories will deal with:

- Structure and development
- Growth regulation and growth responses
- Uptake and transport
- Nutrition and soils
- Water and solutes movements
- Genetics
- Ecology

INSTRUCTOR: A new instructor (Ph.D.) will be hired in the spring of 1993 to develop and teach this course.

LAB INSTRUCTOR: New lab instructors or lab assistants will be hired in the spring of 1993. We contemplate hiring persons with the competence to do the labs in this course.

Biology 304
NAME & NUMBER OF COURSE

LABORATORY EXPERIMENTS:

1. Identification of Psilophyta
2. Identification of Lycophyta
3. Identification of Sphenophyta
4. Identification of Pterophyta
5. Identification of Progymnosperms
6. Identification of Gymnosperms
7. Identification of Angiosperms
8. A study of a British Columbia forest ecosystem:
   a) The physical aspects: temperature, soil pH, weather, climate, etc.
   b) Plant populations and communities.
9. Enzymes: the preparation and investigation of catalase from plant sources.
10. An investigation of the Hill reaction in isolated chloroplast.
11. The role of phytochrome in germination lettuce seeds.
12. The effects of auxin and cytokinin on morphogenesis in callus tissue.

SUPPORTING LAB EQUIPMENT AVAILABLE:

Basic lab equipment such as microscopes, incubators, centrifuges, waterbaths, glassware, pH meters, oxygen electrodes, column and TLC chromatographic apparatus, gel electrophoresis apparatus, tissue homogenizers, and balances are available in our present inventory.

SUPPORTING LAB EQUIPMENT TO BE PURCHASED:

Special needs equipment for the labs in this course will have to be ordered and will be determined by the instructor teaching the course.

Biology 304
NAME & NUMBER OF COURSE

LIBRARY RESOURCES:

BOOKS: *Chemistry and Biochemistry of Plant Pigments*, T.W. Goodwin
Plant Physiology, R.G.S. Bidwell
Biology of Plants, Raven, Evert, and Curtis
Botany: an Ecological Approach, Jensen and Salisbury

JOURNALS: Annual Review of Plant Physiology
Canadian Journal of Botany
Plant Physiology
Plant Biochemistry

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: Fall 1992

Biology 401	Molecular Biology I	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

A study of advanced problems and concepts on topics such as cell organization, cell function and the control of cell division and growth. Students will be required to participate in class seminars designed to analyze the recent scientific literature on topics related to the molecular biology of cells.

COURSE PREREQUISITES: Biology 201 / 202 / 220
Chemistry 211 / 212

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	Lecture	60	hrs	Student Directed Learning hrs
	Laboratory		hrs	
	Seminar	45	hrs	Other - specify:
	Field Experience		hrs	hrs
				TOTAL 105 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	To be determined
SFU	For UCFV - SFU B.Sc. in General Science
UVIC	To be determined
Other	

Terry V.B. Starr, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

B.19

Biology 401
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
Biology 402 Molecular Biology of the Cell II	Biology 402 Molecular Biology of the Cell II Biology 411 Molecular Biology of the Gene

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXTS: *Molecular Biology of the Cell*, Alberts, Bray, Lewis, Raff, Roberts and Watson

Supplemented with current research papers

OBJECTIVES:

The overall emphasis is to give the student a foundation in molecular biology while emphasizing the molecular organization of cells. In addition, students will be required to participate in a weekly seminar series. The critical analysis of current scientific literature related to cell molecular biology is a major theme of this course.

METHODS:

Lecture, Demonstration, Small group practice, Discussion, Audiovisual presentation, Use of models and charts.

STUDENT EVALUATION PROCEDURE:

Midterms	2 × 15%	30%
Lecture final		40%
Seminar final		30%

Biology 401
NAME & NUMBER OF COURSE

COURSE CONTENT

MOLECULAR BIOLOGY I

The course consists of 30 two hour lecture periods per semester. A weekly three hour period will be used for student seminars. These seminars will analyze key scientific papers pertaining to the molecular biology of cells.

Part I Introduction

- chemical principles
- macromolecules

Part II Cell Organization

- plasma membrane
- cytoplasm
- nucleus
- mitochondria
- endoplasmic reticulum
- golgi apparatus
- chloroplasts

Part III Cell Function

- transport across membranes
- cytoskeleton
- control of cell division and growth
- determination and differentiation
- chemical signalling
- energy production
- photosynthesis

Part IV Student Seminars

- weekly student seminar presentations
- analysis of seminar material

Laboratory Experiments

Not required for this course

Biology 401
NAME & NUMBER OF COURSE

LIBRARY RESOURCES:

Molecular Biology of the Gene	Watson et al 4th Ed.
Principles of Gene Manipulation	Old and Primrose
Introduction to Molecular Neurobiology	Zack Hall
Molecular Cell Biology	Darnell, Lodish and Baltimore
Immunology	Roitt, Brotsoff and Male
Annual Reviews of Biochemistry	
Annual Reviews of Genetics	
Annual Reviews of Cell Biology	
Science	
Nature	
PNAS	
Journal of Biological Chemistry	
Journal of Cellular Biochemistry	
Molecular and General Genetics	
Trends in Biotechnology	
Trends in Genetics	
Trends in Endocrinology and Metabolism	

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: Fall 1992

Biology 402	Molecular Biology of the Cell II	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

A study of advanced problems and concepts on topics such as abnormal cell growth, the molecular basis of immunity, and the molecular biology of the nervous system. Students will be required to participate in class seminars designed to analyze the recent scientific literature on topics related to the molecular biology of cells.

COURSE PREREQUISITES: Biology 401: Molecular Biology of the Cell I

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	Lecture	60	hrs	
	Laboratory		hrs	
	Seminar	45	hrs	
	Field Experience		hrs	
	Student Directed Learning			hrs
	Other - specify:			hrs
	TOTAL	105	HRS	

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	To be determined
SFU	For UCFV - SFU B.Sc. in General Science, Double Minors
UVIC	To be determined
Other	

Terry V.B. Starr, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Biology 402
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
None	Biology 401: Molecular Biology of the Cell I Biology 411: Molecular Genetics

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXTS: *Molecular Biology of the Cell*, Alberts, Bray, Lewis, Raff, Roberts and Watson

Supplemented with current research papers

OBJECTIVES:

This course is a continuation of Molecular Biology of the Cell I. The overall objective is to give the student a foundation in molecular biology while emphasizing the specialized topics of cancer, immunology and neurobiology. In addition, students will be required to participate in a weekly seminar series. The critical analysis of current scientific literature related to cell molecular biology is a major theme of this course.

METHODS:

Lecture, Demonstration, Small group practice, Discussion, Audiovisual presentation, Use of models and charts.

STUDENT EVALUATION PROCEDURE:

Midterms	2 × 15%	30%
Lecture final		40%
Seminar final		30%

Biology 402
NAME & NUMBER OF COURSE

COURSE CONTENT

MOLECULAR BIOLOGY I

The course consists of 30 two hour lecture periods per semester. A weekly three hour period will be used for student seminars. These seminars will analyze key scientific papers pertaining to the molecular biology of cells.

Part I Molecular Basis of Cancer

- control of cell proliferation
- genetic basis of cancer
- tumor viruses
- chromosome abnormalities and human cancer
- use of tissue culture cells

Part II Molecular Basis of Immunity

- cells of the immune system
- antibody structure and function
- generation of antibody diversity
- antibody - antigen reactions
- genetic control and regulation of immunity

Part III Molecular Biology of the Nervous System

- cells of the nervous system
- ion channels: structure and function
- synaptic transmission
- neuromuscular connections

Part IV Student Seminars

- weekly student seminar presentations
- analysis of seminar material

Laboratory Experiments

Not required for this course

Biology 402
NAME & NUMBER OF COURSE

LIBRARY RESOURCES:

Molecular Biology of the Gene	Watson et al 4th Ed.
Principles of Gene Manipulation	Old and Primrose
Introduction to Molecular Neurobiology	Zack Hall
Molecular Cell Biology	Darnell, Lodish and Baltimore
Immunology	Roitt, Brotsoff and Male
Annual Reviews of Biochemistry	
Annual Reviews of Genetics	
Annual Reviews of Neuroscience	
Annual Reviews of Immunology	
Annual Reviews of Cell Biology	
Journals	
Science	
Nature	
Neuron	
PNAS	
Journal of Biological Chemistry	
Journal of Neuroscience	
Journal of Cellular Biochemistry	
Journal of Immunology	
Immunology	
Cancer	
Cancer Research	
Trends in Biotechnology	
Trends in Genetics	
Trends in Neuroscience	
Trends in Endocrinology and Metabolism	

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: 1993 02 03

CHEMISTRY 311	Intermediate Organic Chemistry I	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

An intermediate level Organic Chemistry course involving further spectroscopy and condensation reactions, in addition to a study of dienes, lipids, heterocyclic compounds and polymers. The approach will be by reaction mechanism and synthesis. The laboratory work will include organic synthesis and analysis.

With Chemistry 312 this course satisfies organic chemistry requirements towards a Bachelor of General Science degree with a minor in Chemistry.

COURSE PREREQUISITES: Chem 211 and 212

COURSE COREQUISITES:

(Hours listed below assume current UCFV model of 4 lecture and 4 lab "hours" per week: lecture hour is a 50 minute hour, lab hour is a full hour).

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	52 HRS	STUDENT DIRECTED LEARNING	HRS
	LABORATORY	40 HRS		
	TUTORIAL	14 HRS	EXAMS	6 HRS
	FIELD EXPERIENCE	HRS		
			TOTAL	112 HRS

UCFV CREDIT TRANSFER		UCFV CREDIT NON-TRANSFER	X	NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

Not transferable to SFU for credit towards a Chemistry/Biochemistry degree.

Peter W. Slade & Arthur M. Last
COURSE DESIGNER(S)

J.D. Tunstall
DEAN OF ACADEMIC STUDIES

C-1

Chem 311: Intermediate Organic Chemistry I
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
Chemistry 312	Chemistry 212, Biology 300 level

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Organic Chemistry, 3rd edition, John McMurry, (Brooks/Cole), 1992

FVC Laboratory Manual for Chemistry 311 & 312 (in preparation).

Supplementary material from other texts and references. *

REFERENCES:

Organic Chemistry, 2nd edition, L.G. Wade Jr., (Prentice-Hall), 1991 *

Organic Chemistry, K. Peter C. Vollhardt, (W.H. Freeman), 1987 *

Advanced Organic Chemistry, 4th edition, Jerry March, (John Wiley), 1992 *

Monographs on heterocyclics, polymers, natural products *

Spectroscopy texts (e.g. Silverstein & Bassler, Dyer)

OBJECTIVES:

Students enrolling in this course will be pursuing careers in chemistry or biology or hoping to achieve a minor in either or both.

It is intended that students will be able to:

a) Acquire a deeper understanding of the basic principles underlying organic chemistry and apply them to new situations using a systematic and logical approach (e.g., in reaction syntheses).
b) Perform laboratory syntheses and analyses with care, precision, and confidence.
c) Extrapolate the information obtained in class sessions into the laboratory.
d) Demonstrate the connection between organic syntheses and biological systems, where applicable.

Chem 311: Intermediate Organic Chemistry I
NAME & NUMBER OF COURSE

METHODS:

Presentation of the course will be inter-related class (theory), seminar, and laboratory sessions. Class sessions will promote active student participation to ensure continual mutual feedback in order to reinforce the learning process. Films and other audio-visual aids will be used where appropriate.

Problem assignments will be continually given. Some selected problems will be collected and marked.

STUDENT EVALUATION PROCEDURE:

This will be flexible yet will be based on the following:

Laboratory (reports and techniques)	25%
Mid-term examination	25%
Instructor assessment, problem assignments, class participation, other tests	20%
Final examination	30%

Chem 311: Intermediate Organic Chemistry I
NAME & NUMBER OF COURSE

COURSE CONTENT

Chromatography and Mass Spectroscopy: McM. ch 12 (6 hours)

Gas and Liquid chromatography, HPLC, mass spectroscopy.

Nuclear Magnetic Spectroscopy: McM. ch 13 (8 hours)

Review of proton magnetic spectroscopy, more complex splitting patterns; ^{13}C n.m.r. spectroscopy; n.m.r. spectra of larger molecules.

Conjugated Dienes and Ultra-violet Spectroscopy: McM. ch 14 (8 hours)

Preparation and stability of conjugated dienes; molecular orbital description of 1,3-butadiene; electrophilic addition (1,2 & 1,4 addition); Diels-Alder cycloaddition reactions; other conjugated systems. Ultra-violet spectrum of 1,3-butadiene. Ultra-violet spectroscopy of other conjugated systems.

Carbonyl Condensation Reactions: McM. ch 23 (8 hours)

Review of aldol condensation reactions (from 212); Claisen condensation reaction, Dieckmann reaction; Michael reaction, Stork enamine reaction, carbonyl condensation reactions in syntheses, Wittig reaction, Robinson annulation; and in biological systems.

Lipids: McM. ch 28 (6 hours)

Review of fats, oils, waxes, soaps; phospholipids, prostaglandins, terpenes, steroids, biosynthesis of steroids, stereochemistry of steroids.

Heterocyclic Compounds: McM 29 (6 hours)

Structures of five membered rings: pyrrole, furan, thiophene; electrophilic substitution. Structures of six-membered rings: pyridine - electrophilic and nucleophilic substitution. Fused heterocycles.

Synthetic Polymers: McM 31 (10 hours)

Classes of polymers, radical polymerization of alkenes, cationic and anionic polymerization, addition polymers, condensation polymers; common examples: nylon, polyester, polyurethane; polymer structure and properties.

Chem 311: Intermediate Organic Chemistry I
NAME & NUMBER OF COURSE

LABORATORY EXPERIMENTS Ten laboratory periods of four hours each. All experiments are one week in duration unless otherwise stated.

To be selected by instructor from:

1. A Diels-Alder reaction: cyclopentadiene + maleic anhydride ---> endo-bicyclo [2:2:1] hept-5-en-2,3-dicarboxylic anhydride. Students run an n.m.r. spectrum).

2. A Diels-Alder reaction continued: adduct from 1 + bromine ---> exo cis 2,3-dibromo-endo-bicyclo [2:2:1] heptan-5,6-dicarboxylic anhydride. Students run infra-red and n.m.r. spectra.

3. Qualitative Analysis (single unknowns): Sodium fusion tests, functional group tests and full identity by derivative and/or by i.r and n.m.r. spectroscopy (perhaps 2 or 3 of this type). {2 weeks}

4. Robinson Annulation experiment (ref.: J. Chem Ed. 65, 637, July 1988).

5. Polarimetry: resolution of (±) sec-butylamine or (±) α-phenylethylamine.

6. Heterocyclic compound: Synthesis of 4-methyl-6-hydroxypyrimidine.

7. Synthesis of Lidocaine - a local anaesthetic (ref. SFU Chem 255). 2,6-dimethylaniline + chloroacetyl chloride ---> α-chloro-2,6-dimethylacetanilide. Then latter + diethylamine ---> lidocaine. Students run infra-red and n.m.r. spectra. {2 weeks}

8. Fats and Oils: (ref. SFU Chem 255).
   (Saponification of a fat or oil,
   Iodine number determination)
   Fatty acid esterification and subsequent GC analysis.

9. Mass Spectoscopy lab. (assistance from SFU regarding analyses until own instrument obtained).

10. A project involving multi-step synthesis (of compounds to be decided later), analyzing products by i.r. and n.m.r. spectroscopy. {2 weeks}

11. Condensation reaction: Synthesis of Ethyl Acetoacetate. (Purification by column chromatography).

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCES DATE: 1993 02 03

CHEMISTRY 312	Intermediate Organic Chemistry II	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The topics covered include an introduction to the chemical literature, the investigation of reaction mechanisms, industrial organic chemistry, molecular orbital theory and an extension of the spectroscopy and biochemical topics. The laboratory work will illustrate a number of topics covered during lectures including photochemistry, a study of the properties of polymers, physical-organic chemistry and a short project. With Chemistry 311 this course satisfies organic chemistry requirements towards a Bachelor of General Science degree with a minor in Chemistry.

COURSE PREREQUISITES: Chem 311

COURSE COREQUISITES:

(Hours listed below assume current UCFV model of 4 lecture and 4 lab "hours" per week, i.e. lecture hour is a 50 minute hour, lab hour is a full hour).

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	52 HRS	STUDENT DIRECTED LEARNING	HRS
	LABORATORY	40 HRS		
	TUTORIAL	12 HRS	EXAMS 6	HRS
	FIELD EXPERIENCE	HRS		
			TOTAL 112	HRS

UCFV CREDIT TRANSFER		UCFV CREDIT NON-TRANSFER	X	NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

Not transferable to SFU for credit towards a Chemistry/Biochemistry degree.

Arthur M. Last & Peter W. Slade — COURSE DESIGNER(S)

J.D. Tunstall — DEAN OF ACADEMIC STUDIES

C.6

Chem 312: Intermediate Organic Chemistry II
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
	Chemistry 311; Biology 300 level

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Advanced Organic Chemistry, 4th edition, Jerry March, (John Wiley), 1992

or Introduction to Organic Chemistry, 4th edition, Andrew Streitweiser, Clayton Heathcock & Edward Kosower, (MacMillan), 1992

Supplementary material from various sources given in course content section.

FVC Laboratory Manual for Chemistry 311 & 312 (in preparation).

REFERENCES: see course content section

OBJECTIVES:

Students enrolling in this course will be pursuing careers in chemistry or biology or a minor in either or both subjects.

It is intended that students will be able to:

a) Acquire a deeper understanding of the basic principles of organic chemistry and apply them to new situations using a systematic and logical approach (e.g. in reaction syntheses).
b) Perform laboratory syntheses and analyses with care, precision, and confidence.
c) Extrapolate the information obtained in class sessions into the laboratory.
d) Demonstrate the connection between organic syntheses and biological systems, where applicable.
e) Acquire an expertise in searching the chemical literature.

Chem 312: Intermediate Organic Chemistry II
NAME & NUMBER OF COURSE

METHODS:

Presentation of the course will be inter-related class (theory), seminar, and laboratory sessions. Class sessions will promote active student participation to ensure continual mutual feedback in order to reinforce the learning process. Films and other audio-visual aids will be used where appropriate.

Problem assignments will be continually given. Some selected problems will be collected and marked.

STUDENT EVALUATION PROCEDURE:

This will be flexible yet will be based on the following:

Laboratory (reports and techniques)	25%
Mid-term examination	25%
Instructor assessment, problem assignments, class participation, other tests	20%
Final examination	30%

COURSE CONTENT (references given in addition to texts)

Introduction to the primary journals and review journals of Organic Chemistry (8 hours)

Hands-on experience in the use of **Chemical Abstracts** (field-trip to SFU), computer searching (SFU assistance desirable), introduction to primary journals, to review journals and to other reference materials such as **Beilstein**, the **Dictionary of Organic Compounds** and **Science Citation Index**.

reference materials:

Using Chemical Abstracts - Peter Groves (Royal Society of Chemistry Audiotape), 1984

How To Find Chemical Information - Robert E. Maizeli (2nd edition) (John Wiley), 1987

Chem 312: Intermediate Organic Chemistry II
NAME & NUMBER OF COURSE

COURSE CONTENT (continued).....

The Investigation of Organic Reactions (20 hours)

Discussion of the various techniques used to investigate reaction mechanisms. Topics included: kinetics and equilibrium studies (6 hr), isotope effects (2 hr), structure-reactivity relationships (e.g. the Hammett equation) (6 hr), and stereochemistry (6 hr).

reference materials:

Mechanism: An Introduction to the Study of Organic Reactions - Richard A. Jackson (Oxford University Press), 1972

The Investigation of Organic Reactions - Ross Stewart (Prentice-Hall), 1966

Physical Organic Chemistry Through Solved Problems - Joseph B. Lambert (Holden-Day), 1978

Mechanism in Organic Chemistry: Case Studies - R.O.C. Norman, M.J. Tomlinson & D.J. Waddington (Mills & Boon), 1978

various original papers and reviews from J. Organic Chem., Chem. Reviews etc.

Industrial Organic Chemistry (8 hours)

Petrochemicals, dyes & dyeing, pharmaceuticals: emphasis on Canadian content.

reference materials:

Survey of Industrial Chemistry - P.J. Chenier (Wiley-Interscience), 1986

The Second 50 Industrial Chemicals, Parts 1 & 2 - P.J. Chenier & D.S. Artibee (J. Chem. Ed. 65, 244-250, 433-436, 1988)

The Teaching of Industrial Organic Chemistry - M.B. Hocking (Can. Chem. News 19-23, March 1991)

Organic Chemistry - Norman L. Allinger et al (chapter 35) (Worth), 1971

various articles and news items from C. & E. News, Chemistry & Industry etc.

Chem 312: Intermediate Organic Chemistry II
NAME & NUMBER OF COURSE

COURSE CONTENT (continued).....

Molecular Orbital Systems and Spectroscopy (12 hours)

Molecular orbitals: basic theory, conjugated pi systems and pericylic reactions; electrocyclic reactions; cycloadditions; Woodward-Hofmann rules, further u.v.-visible spectroscopy.

reference material:

Organic Chemistry - 3rd edition - John McMurry (Brooks/Cole) ch 30, 1992

Organic Chemistry - Alan Wingrove & Robert L. Caret (Harper & Row) ch 27, 1981

"Special Topics" (6 hours)

Proteins (synthesis from amino acids, Merrifield Automated method, protein analysis), enzymes, nucleic acids and nucleotides.

reference material:

Organic Chemistry - 3rd edition - John McMurry (Brooks/Cole) ch 29, 1992

Organic Chemistry - Alan Wingrove & Robert L. Caret (Harper & Row) ch 28, 1981

Chem 312: Intermediate Organic Chemistry II

LABORATORY EXPERIMENTS ***Ten laboratory periods of four hours each. All experiments are one week in duration unless otherwise stated.***

These will be comprised of some standard experiments and some project work. The standard experiments will be selected by the instructor from a given list that will include but will not be restricted to:

1. *The Perkin reaction: preparation of cis and trans-2-phenylcinnamic acid.*
2. *Photochemical and Thermal Interconversion of cis and trans -1,4-diphenyl-2-butene-1,4-dione.*
3. *Qualitative Analysis (binary unknowns): Sodium fusion tests, functional group tests, separation and full identity by derivative and/or by i.r and n.m.r. spectroscopy. {2 weeks}*
4. *The Small Scale Preparation of a variety of Polymers.*
5. *The Synthesis of Tyrian Purple. {2 weeks}*
6. *The Photochemical Dimerization of 4-methylbenzophenone.*
7. *The Preparation of tropylium iodide.*
8. *U.V.-Visible Spectroscopy: The Determination of the pK_a of a Weak Acid.*
9. *As an alternative to some of the above, a suitable project will be selected by the more capable students, in consultation with the instructor. These projects will involve either the specific aspects of a given mechanism (e.g. several students might work together to prepare a number of substituted aromatic compounds, do a kinetic study and produce a Hammett plot) or a multi-step synthesis of a compound of commercial significance (e.g. a dye, a pharmaceutical product etc.). A project list will be developed.*

EQUIPMENT NEEDED FOR UPPER LEVEL COURSES

ORGANIC CHEMISTRY (CHEMISTRY 311 & 312)

LIST "A" — EQUIPMENT THAT MUST BE PURCHASED TO RUN COURSES IN 1993/94

		estimated cost
nuclear magnetic resonance spectrometer	1	$ 95,000.00
polarimeter(s)	2	$ 4,000.00
organic quick-fit lab kits	12	$ 10,000.00
melting point apparatus (a) Gallenkamp - (b) Fisher-Johns - (c) new ones on trial basis,	have 3 have 2 need them	$ 10,000.00
solvent evaporator	1	$ 3,500.00
chromatography/electrophoresis apparatus	2	$ 4,000.00
vacuum pumps	2	$ 6,000.00
ice-making machine	1	$ 3,700.00
machine for making dry ice (solid CO_2)	1	$ 600.00
emergency breathing apparatus	2	$ 100.00
explosion-proof refrigerator	1	$ 4000.00
ultra-violet lamps for photochemistry	4	$ 2000.00

LIST "B" — EQUIPMENT THAT WILL BE NEEDED IN THE FUTURE

high pressure liquid chromatograph	1	$ 22,000.00
computers for students (386-DX machines) (we really should have some of these NOW!)	6	$ 12,000.00
computer software for the above	6	$ 3,000.00
mass spectrometer	1	$ 50,000.00

LIST "C" — EQUIPMENT CURRENTLY AVAILABLE

infra-red spectrometers	*have 2 (1 new)*		
u.v./visible spectrometers	*have 3 (1 old, 1 new)*		
refractometers (Bausch & Lomb)	*have 3*		
gas chromatographs	*have 3 (2 old, 1 new)*		
melting point apparatus	*(a) Gallenkamp - have 3*		
	(b) Fisher-Johns - have 2		
	(c) new ones on trial basis need them		*$ 10,000.00*
organic quick-fit lab kits	*have 24*	*(need 12 more)*	*$ 10,000.00*
solvent evaporator	*have 1*	*(need 1 more)*	*$ 3,500.00*

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Natural Sciences **DATE:** Fall 1992

Chemistry 321	Intermediate Inorganic	4
NAME & NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CREDIT**

CATALOGUE DESCRIPTION:

Chemistry 321 is designed for students taking a Chemistry minor at UCFV. The course concentrates on the chemistry of non-transition elements and their compounds, with emphasis on bonding, periodic properties and the descriptive chemistry of chosen groups.

COURSE PREREQUISITES: UCFV Chemistry 221

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**60 hrs**	**Student-Directed Learning**	**hrs**
	Laboratory	**40 hrs**		
	Seminar	**hrs**	**Other - specify:**	
	Field Experience	**hrs**		**hrs**
			TOTAL	**100 hrs**

UCFV CREDIT TRANSFER [X] **UCFV CREDIT NON-TRANSFER** [ ] **NON-CREDIT** [ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC

SFU

UVIC

Other

Dr. N.S. Dance
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

C.15

Intermediate Inorganic Chemistry
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
Chemistry 421	

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXTS: "Inorganic Chemistry," G.L. Miessler and D.A. Tarr, 1991 Ed., Prentice-Hall Publishers, ISBN 01-346-56598.

UCFV Laboratory Manual for Chemistry 321.

OBJECTIVES:

The course is designed to enable students to:-

(1) Relate theories of bonding and structure to the properties of inorganic materials.

(2) Perform laboratory work safely and with care and precision.

(3) Interpret laboratory results in terms of theoretical material covered in the course, and to understand the relationship between experimental and theoretical science.

METHODS:

Presentation of the course will be by inter-related theory classes ("lectures"), discussion periods ("seminars") and laboratory sessions. Audio-visual aids will be used where appropriate, and students will be given instruction in the use of various instrumental techniques, and in the use of an academic library.

STUDENT EVALUATION PROCEDURE:

Evaluation will be based on the following system:

First In-Term Test	20%
Second In-Term Test	20%
Laboratory (reports and technique)	25%
Final Examination	35%

Chemistry 421: Advanced Inorganic Chemistry
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Theories of Atomic Structure. Introduction to wave mechanics.

2. Theories of Bonding. Application of VSEPR theory, molecular orbital theory, valence bond theory to inorganic systems.

3. The Solid State. Metals, ionic solids, covalent solids, silicates and semi-conductors.

4. Chemical Properties of Main-Group Elements and their Compounds, in Relation to the Periodic Table.

5. Thermodynamic and Kinetic Effects in Main-Group Chemistry.

6. Descriptive Main-Group Chemistry. Selected topics will concentrate on the chemistry of:-

   (a) hydrogen
   (b) Group 14
   (c) Group 16
   (d) Electron-deficient compounds
   (e) Recent advanced in inorganic chemistry

Chemistry 321 Intermediate Inorganic Chemistry.
NAME & NUMBER OF COURSE

Laboratory Experiments.

Experiment 1. Preparation and Thermal Decomposition of an Electron-deficient Compound, $[C_6H_5)_3P]_2CuBH_4$.

Experiment 2. Preparation of Tin(IV) Iodide and Two Derivatives, $[Et_4N]_2[SnI_4Cl_2]$ and $SnI_4(PPh_3)_2$.

Experiment 3. Preparation and NMR of Tris(2,4-pentanedionato)silicon hydrogendichloride.

Experiment 4. Preparation and Spectroscopy of Ph_4Sn and derivatives.

Experiment 5. Infra-Red Spectroscopy of Deutero-Substituted Compounds.

Experiment 6. Preparation of $(EtOPh)_2Te$ and $(EtOPh)_2TeCl_2$.

Experiment 7. Spectroscopy (Ir, NMR and Mass spec) of $(EtOPh)_2Te$ and $(EtOPh)_2TeCl_2$.

Experiment 8. Periodicity; The Chemistry of Group 14 (C —> Pb) Compounds.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Nat. Sci. (Chemistry) DATE: Oct 6, 1992

Chemistry 322-4	Intermediate Physical	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: This course continues on from Chemistry 222. The first section will consist of a study of electrolytes and non-electrolytes in solution and the second section will be an introduction to quantum mechanics.

COURSE PREREQUISITES: Chemistry 222, Math 211, Phys ?

(Hours listed below assume 4 lecture and 4 lab hours per week.)

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	56	HRS	STUDENT DIRECTED LEARNING - HRS
	LABORATORY	40	HRS	
	SEMINAR		HRS	OTHER - specify: Extra lab time will be used for exams and teaching extra math 16 HRS
	FIELD EXPERIENCE		HRS	
				TOTAL 112 HRS

UCFV CREDIT TRANSFER	☐	UCFV CREDIT NON-TRANSFER	☐	NON-CREDIT	☐

TRANSFER STATUS (Equivalent, Unassigned, Other Details)
Upper level courses are not assigned transfer credit.

Lillian Martin
COURSE DESIGNER

DON TUNSTALL, Ph.D.
DEAN OF ACADEMIC STUDIES

C.19

Chemistry 322
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: N.A.	RELATED COURSES: Chemistry 222, Chemistry 421, Physics 351

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Physical Chemistry, 2nd Edition, Bromberg, J.P. Allyn and Bacon

OBJECTIVES: Students will understand currents theories on the behaviour of substance is aqueous solutions. this will include experimental determination of activities, applications of the Gibbs-Duhem equation and Debye-Hückel theory.
In the second (and longer) section of the course students will come to understand the postulates of quantum mechanics and how they are applied to electrons, atom and molecules. by the end of the course students should understand the basics of molecular orbital theory. Students will be able to relate the information obtained in the laboratory experimentation to the theorectical presentations in lectures.

METHODS:

Lecture; Laboratory sessions will be used partly for experimentation and party for work and for mid-term examinations.
STUDENT EVALUATION PROCEDURE:

Assignments	10%
Labs	25%
Mid-terms	30%
Final	35%

Chemistry 322
NAME & NUMBER OF COURSE

COURSE CONTENT The course will cover chapters 14-17 and 20-27 of Bromberg. Lab experiments will illustrate the principles of the lectures.

Activities of Nonelectrolyte Solutions
Ions in Solution
Activities of Ions. The Debeye-Hückel Theory
Electrochemical Cells
Corpuscles, Waves and the Nuclear Atom
Preliminaries to Quantum Mechanics
The Postulates of Quantum Mechanics. Applications to Simple Systems.
Rotations and Vibrations of Molecules
The Hydrogen Atom
Approximate Methods, the Helium Atom and Selection Rules
Electron Spin and More Complicated Atoms
Molecules and Chemical Bonding.

Laboratory Experiments.
(Four of the following experiments would be chosen)

Conductance of Solutions
Activity Coefficients from Cell Measurements
Temperature Dependence of EMF
The Spectrum of the Hydrogen Atom
The Spectrum of HCl and DCl
The Spectrum of Iodine
(Extra lab time woiuld be used for lab write-ups, seminars, exams and group study sessions.)

Chemistry 322
NAME & NUMBER OF COURSE

INSTRUCTOR: TBA
The instructor hired to teach this course would have an M.Sc. (preferrably a Ph.D) in physical chemistry with special expertise in quantum mechanics and spectroscopy.

LAB INSTRUCTOR: Students will be responsible for setting up and running their own labs and a separate lab instructor will not be required. It is assumed, however that a lab assistant with the necessary expertise to ensure the equipment is in good running order will be on staff. Generally the lecturer will be responsible for the lab component of the course.

Chemistry 322
NAME & NUMBER OF COURSE

Supporting Lab Equipment Available

1) Constant temperature water baths
2) Conductivity meters and cells
3) Perkin-Elmer Lamda 2 UV-Vis Double Beam Scanning Spectrophotometer. (resolution 2 nm, 10 cm cell handling capability)
4) Perkin-Elmer FT-IR Model 1605 (resolution 2 cm^{-1})

Supporting Lab Equipment to be Purchased
1) Modified conductivity cell
2) Electrochemical cell with H_2 and Ag-AgCl electrodes
3) Hydrogen gas cylinder and regulator
4) Necessary equipment for the hydorgen atom spectrum experiment. This would include: a hydrogen discharge tube, a low pressure Hg lamb, power supplies, camera and spectrograph, calibration equipment. (Students may be able to use a existing dark room to develop the films.)

Cost estimate on items 1) through 4) cannot be generated on such short notice. I estimate it would be $6000 to $8000.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Natural Sciences **DATE:** Fall 1992

Chemistry 421	Advanced Inorganic Chemistry	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

Chemistry 421 is designed for students taking a Chemistry minor at UCFV. The course concentrates on organo-transition metal chemistry, with emphasis on bonding theories, the 18-electron rule and cluster compounds. Emphasis will be placed on the role of organometallic complexes in organic synthesis.

COURSE PREREQUISITES: UCFV Chemistry 321

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**60 hrs**	**Student-Directed Learning**	**hrs**
	Laboratory	**40 hrs**		
	Seminar	**hrs**	**Other - specify:**	
	Field Experience	**hrs**		**hrs**
			TOTAL	**100 hrs**

UCFV CREDIT TRANSFER	[X]	**UCFV CREDIT NON-TRANSFER**	[ ]	**NON-CREDIT**	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC

SFU

UVIC

Other

Dr. N.S. Dance
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

C.25

Advanced Inorganic Chemistry
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES
None	

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXTS: There is no assigned text. Reprint material will be used extensively.

UCFV Laboratory Manual for Chemistry 421.

OBJECTIVES:

The course is designed to enable students to:-

(1) Relate theories of bonding and structure to the properties of organometallic compounds.

(2) Perform laboratory work safely and with care and precision.

(3) Gain experience in using air-sensitive compounds, and to use laboratory equipment, such as vacuum lines and dry boxes.

(4) Interpret laboratory results in terms of theoretical material covered in the course, and to understand the relationship between experimental and theoretical science.

(5) Appreciate the role of organometallic catalysts in organic synthesis.

(6) Carry out a directed research project, involving either laboratory work or library research.

METHODS:

Presentation of the course will be by inter-related theory classes ("lectures"), discussion periods ("seminars") and laboratory sessions. Audio-visual aids will be used where appropriate, and students will be given instruction in the use of various instrumental techniques, and in the use of an academic library. The course will include a directed research project.

STUDENT EVALUATION PROCEDURE:

Evaluation will be based on the following system:

First In-Term Test	15%
Second In-Term Test	15%
Laboratory (reports and technique)	15%
Research Project	20%
Final Examination	35%

Chemistry 421: Advanced Inorganic Chemistry
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Theories of Bonding. Molecular orbital description of bonding; the 18-electron rule; hard and soft ligands.

2. The use of spectroscopic techniques in characterizing organometallic compounds. Time scales of various physical techniques.

3. A description of bonding of common ligands (carbon monoxide, hydride, phosphine, olefine, carbene, etc.) in organo-transition metal compounds.

4. Metal cluster compounds.

5. The isolobal concept; the 16/18-electron rule and its exceptions.

6. Arene-transition metal complexes.

7. Oxidative-addition (reductive-elimination) reactions.

8. The role of organo-transition metal complexes in organic synthesis.

Chemistry 421 Advanced Inorganic Chemistry.
NAME & NUMBER OF COURSE

Laboratory Experiments.

Experiment 1. Preparation of Zeise's Salt, $K[PtCl_3(C_2H_4)].H_2O$.

Experiment 2. Preparation and Characterisation of $RhCl(PPh_3)_3$.

Experiment 3. Preparation of $[CH_3C_5H_4Mn(CO)_2NO][PF_6]$.

Experiment 4. Preparation of mesitylenetricarbonylmolybdenum(0).

Experiment 5. Preparation of a Metal cluster Complex.

Experiment 6. Use of organometallis complexes in Organic Synthesis (I).

Experiment 7. Use of organometallis complexes in Organic Synthesis (II).

Laboratory Equipment Required for Upper Level Inorganic Chemistry.

Only equipment required specifically for the Inorganic courses are listed.

	Item	Quantity	
1.	Gouy balance.		1
2.	Dry Boxes.		2
3.	Vacuum line	1	
4.	Vacuum pump	1	
5.	Heating Mantles		6
6.	Stirrer motors	6	
7.	Rotary Evaporators	2	
8.	Manometer		1
9.	Sublimation cold-fingers	4	
10.	Gas cylinder (N_2)		1
11.	Gas cylinder (CO)		1
12.	Sets of glassware (with ground glass joints) including reaction flasks, condensers, connectors, traps etc.	6	
13.	Assorted glassware.		

Instructor Qualifications.

The instructors for both Chemistry 321 and 421 will be expected to have a PhD with emphasis on inorganic chemistry. While assignments of classes for next year have not yet been made, the following instructors, currently employed at UCFV, are considered to be qualified to teach either of the courses.

Nigel S. Dance.

Presently teaching Chem 221 (Inorganic Chemistry) at UCFV. Fourteen years experience of teaching at UCFV. PhD and subsequent research experience is in main-group organometallic chemistry, with emphasis on spectroscopy.

Lillian Martin.

Presently teaching Chem 222 (Physical Chemistry) at UCFV. Seven years experience of teaching within the community college system. PhD and subsequent research experience is in the area of organometallic chemistry.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Natural Science (Chemistry) DATE: Oct. 15, 92

Chemistry 441	Analytical/Spectroscopy	4
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: This course will cover the fundamentals of modern analytical chemistry and applied spectroscopy. Lecture material includes data and sample handling, classical techniques, instrumental methods, the principles of chromatogrphy and applied spectroscopy. Laboratory experiments will illustrate the lecture material.

COURSE PREREQUISITES: Any three of Chemistry 211, 212, 221, 222.

(Hours listed below assume 4 lecture and 4 lab hours per week.)

HOURS PER TERM FOR EACH STUDENT			
	56 LECTURE	HRS	STUDENT DIRECTED LEARNING - HRS
	32 LABORATORY	HRS	
	SEMINAR	HRS	OTHER - specify: 24 hours of extra lab time will be used for exams and seminars. - HRS
	FIELD EXPERIENCE	HRS	
			112 TOTAL HRS

UCFV CREDIT TRANSFER	☐	UCFV CREDIT NON-TRANSFER	☐	NON-CREDIT	☐

TRANSFER STATUS (Equivalent, Unassigned, Other Details)
(Upper level courses are not usually assigned transfer credit.)
UBC

SFU

Lillian Martin
COURSE DESIGNER

DON TUNSTALL, Ph.D.
DEAN OF ACADEMIC STUDIES

Chemistry 441
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES: Chemistry 321, 322, 421

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:
Fundamentals of Analytical Chemistry by Skoog et al. Required.

OBJECTIVES:
Students will become competent with a wide variety of analytical techniques. They will be able to display their expertise in understanding the lecture material and handling the labortaory equipment. They will posses the knowledge necessary to assess the reliability of both new and existing analytical methods.

METHODS: Lectures, labs, group problem solving sessions. (Some of the labs will be projects the students will plan themselves.)

Lecture, Demonstration, Small group practice, Discussion, Audiovisual presentation, Use of models and charts.

STUDENT EVALUATION PROCEDURE:

Mid-terms.....25%
Labs.....45%
Final.....30%

Chemistry 441
NAME & NUMBER OF COURSE

COURSE CONTENT

1)Data Handling--Uncertainty and errors, accuracy and precision, calibration of instruments, blanks and standards
2)A brief overview of the nature of solutions and equilibrium considerations.
3)Gravimetric and volumetric techniques
4)Principles of chromatography
5)Principles of applied spectroscopy

Instructor: TBA

The instructor hired to teach this course would have an MSc (preferrably a PhD) with expertise in analytical chemistry and applied spectroscopy.

Lab Instructor:

Students will be responsible for setting up and running their own labs and a separate lab instructor will no be required. It is assumed, however, that a lab assistant with the necessary expertise to ensure the equipment is in good running order will be on staff. Generally the lecturer will be responsible for the lab component of the course.

Chemistry 441
NAME & NUMBER OF COURSE

LABORATORY EXPERIMENTS

1)Analysis of 50 samples of lake water with and an autoanalyzer
2)Gravimetric lab
3)ISE lab
4)ICP lab
5)GC lab
6)HPLC lab
7) & 8) Qualitative analysis of unknowns using NMR and IR tecniques
9)Volumetric lab using an autotitrator.

Supporting Lab Equipment Available

Analytical Balances
Ion Selective Electrodes
Potentiometrs (pH meters)
Gas Chromotographs
FT-IR

Supporting Lab Equipment to be Purchased

Autoanalyzer for nitrates and nitrites
Autotitrator
HPLC ($22,000)
NMR ($90-100,000)
Inductively Coupled Plasma ($80-1000)

Chemistry 441

LIBRARY RESOURCES

Title	Author
Analytical Chemistry for Technicians	Kenkel
Analysis	Marson
An Introduction to the Physics and Chemistry of Petroleum	Kinghorn
The analytical Approach	Grasselli
Fundamentals of Analytical Chemistry	Skoog etc
Fundamentals of Molecular Spectroscopy	Banwell
Chromatography [Videorecording]	
Laboratory Manual in Food Chemistry	Wooks etc
Official Methods of Analysis of the Association of Official Analytical Chemists	Horwitz
Analysis of Foods and Beverages	Schenk etc
Organic Functional Group Analysis by Gas Chromatography	Ladas
Handbook of Analytical Chemistry	
Qualitative Chemical Analysis	Kolthoff etc
Chemical Principles in the Laboratory	
An Introduction to NMR Spectroscopy [sound recording]	Gilbert and Norman

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 311	Statistical Physics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

This course introduces students to the advanced methods of statistical physics. Connections with thermodynamics are emphasized. Topics include canonical ensembles, partition functions, quantum statistics

COURSE PREREQUISITES: Physics 231 (Thermodynamics)

Physics 252 (Modern Physics)

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	Lecture	60 hrs	Student Directed Learning	hrs
	Laboratory	hrs	Other - specify:	
	Seminar	hrs		hrs
	Field Experience	hrs	TOTAL	60 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

Rob Woodside, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Physics 311
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Fundamentals of Stastical and Thermal Physics, F. Reif, McGraw Hill (1965)

REFERENCES: Thermal Physics, Kittel

Statistical Mechanics, Huang

OBJECTIVES:

To introduce the student to the methods of statistical physics.

METHODS:

This course will be taught using lectures, demonstrations, and computer simulations. Problems will be assigned and marked on a regular basis.

STUDENT EVALUATION PROCEDURE:

Assignments	25%
Midterm Examination	30%
Final Examination	45%

Physics 311
NAME & NUMBER OF COURSE

COURSE CONTENT

Week	Topic	Reif Chapter
1 - 2	Introduction to statistical methods (Random Walk)	1
3 - 4	Statistical description of systems of particles	2
5 - 6	Brief review of thermodynamics	4 - 5
7 - 8	Basic methods - microcanonical and grand canonical ensembles and connection with thermodynamics	6
9 - 10	Applications - partition functions, ideal gases, conduction electron theory, equipartition theorem, paramagnetism, equilibrium of dilute gases	7 - 8
11 - 12	Quantum statistics	9

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 321	Advanced Mechanics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The object of this course is to extend the concepts studied in Physics 221. Topics to be covered include: Newtonian mechanics, oscillations, gravitation, central forces, motion in noninertial reference frames, Hamilton's Principle and Lagrange's equations, systems of particles, dynamics of rigid bodies. Although this course has no lab component, the emphasis will be shared equally between the theoretical and the applied aspects of the physics being studied.

COURSE PREREQUISITES: Physics 221

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	Lecture	60 hrs	Student Directed Learning	hrs
	Laboratory	hrs		
	Seminar	hrs	Other - specify:	
	Field Experience	hrs	_____	hrs
			TOTAL	60 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

G. McGuire
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Physics 321
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS **(List reading resources elsewhere)**

TEXT: Marion & Thornton, CLASSICAL DYNAMICS, 3rd edition, HBJ, 1988
(Did consider Symon, but felt Marion was more modern).

REFERENCES:

1. Norwood, J., INTERMEDIATE CLASSICAL MECHANICS, Prentice-Hall, NJ
2. Symon, MECHANICS, 3rd edition, 1971, Addison Wesley
3. Goldstein, CLASSICAL MECHANICS, 2nd edition, 1981, Addison Wesley
4. Baierlein, R., NEWTONIAN DYNAMICS, McGraw-Hill, 1983

OBJECTIVES:

1. To increase the students' knowledge of Newtonian mechanics.
2. To increase the students' awareness of the important role Newtonian mechanics has played in the development of all the sciences.
3. To provide the knowledge and the discipline needed to continue a career in physics.
4. To provide an opportunity for the students to experience the joy of thinking.

METHODS:

This course will be taught using lectures, demonstrations, and computer simulations. Problems will be assigned and marked on a regular basis.

STUDENT EVALUATION PROCEDURE:

The marks earned in this course will be calculated from the assignment grade, the midterm and final exams.

Assignments	25%
Midterm Exam	30%
Final Exam	45%

Physics 321
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Mathematical Physics
   Coordinate Transformations, Gradient, Divergence, Curl

2. Newtonian Mechanics (a review)
   Newton's Law, Conservation Theorems, Rocket motion, limitations of Newtonian mechanics

3. Oscillations
   damped and forced, sinusoidal driving forces, Fourier series, impulsive forces, phase diagrams for nonlinear systems

4. Central Forces and Gravitation
   orbits in a central field, reduced mass, effective potential, orbital dynamics

5. Methods in the Calculus of Variations
   Euler's Equation, functions with several dependent variables

6. Hamilton's Principle and Lagrangian Dynamics
   General coordinates, Lagrangian Dynamics, Hamiltonian Dynamics, phase space

7. Systems of Particles
   Centre of Mass, Linear Momentum, Angular Momentum, Collisions

8. Non-inertial Reference Frames
   Rotating Coordinate Systems

9. Dynamics of Rigid Bodies
   Angular momentum, moments of inertia, Inertia Tensor, Eulerian Angles

P.6

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 322	Advanced Electromagnetism	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

This course reviews and deepens the concepts discussed in Physics 112 & 222. Maxwell's equations are examined from several perspectives and the link between them and special relativity is explored. The propagation, reflection, transmission, refraction and polarization of e/m waves is explored.

COURSE PREREQUISITES: Physics 222

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	Lecture	60 hrs	Student Directed Learning	hrs
	Laboratory	hrs		
	Seminar	hrs	Other - specify:	
	Field Experience	hrs	_____	hrs
			TOTAL	60 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

Tim Cooper
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

P.7

Physics 322
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT: Electromagnetic Fields & Waves, Lorrain, Corson & Lorrain

REFERENCES: 1. Foundations of Electromagnetic Theory, J. Reitz and F. Milford. Addison-Wesley.

2. Introduction to Electrodynamics, Griffiths, Prentice Hall.

OBJECTIVES:

1. To get the student solving Maxwell equations in various circumstances.
2. To show the intimate link between special relativity and the magnetic field.

METHODS:

Lecture, Demonstration, Computer simulations etc.

STUDENT EVALUATION PROCEDURE:

Assignments	25%
Midterm Exam	30%
Final Exam	45%

P.8

Physics 322
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Electrostatic fields in a vacuum: Coulomb's Law, potential, conductors and insulators, Gauss' Law and its applications, electric dipoles and multipoles, energy and mechanical forces in an electric field.
2. Dielectric materials: polarization, external and internal electric fields, electric displacement, susceptibility and dielectric constant. Simple boundary value problems involving dielectrics.
3. Solutions to Laplace's and Poisson's equations: continuity at an interface, images, problems with rectangular, spherical and cylindrical symmetries.
4. Basic concepts of special relativity, the Lorentz transformation, transformation of velocity, acceleration, mass, four-vectors, the four-momentum, transformation of an electric charge density and of an electric current, the four-current density.
5. Electric and magnetic fields of moving charges, field of a charge with constant velocity, transformation of electric and magnetic fields and potentials, Maxwell's equations.
6. The vector potential, Biot-Savart law. Calculations of the vector potential and magnetic induction from currents, Ampère's law.
7. The Lorentz force, Faraday's Law. Maxwell's equations compared in integral and differential form, e/m waves, impedence of media, energy densities, Umov-Poynting vector.
8. Reflection/Refraction, Snell's law, Brewster angle, waves at a boundary, transmission and reflection. Radiation pressure. Course finishes with Chapter 32 of text.

- Special relativity - to be covered in second year Modern Physics.
- may have to sop up students from other institutions into 3rd year; they may be coming in with very different backgrounds.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 351	Quantum Mechanics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

This fundamental course on Quantum Mechanics is the gateway to modern physics. Schrödinger equation and basic postulates of the theory will be examined. Topics will include Angular Momentum, Hydrogen atom, Perturbation Theory.

4 Math requirements in 2nd year
- ODE's
- linear algebra – 2nd year
- calculus II
- vector calculus.

COURSE PREREQUISITES: Physics 252 (Modern Physics)

COURSE COREQUISITES: Physics 381 (Mathematical Physics)

HOURS PER TERM FOR EACH STUDENT				
	Lecture	60	hrs	Student Directed Learning hrs
	Laboratory		hrs	
	Seminar		hrs	Other - specify:
	Field Experience		hrs	hrs
				TOTAL 60 HRS

UCFV CREDIT TRANSFER	UCFV CREDIT NON-TRANSFER	NON-CREDIT
[X]	[ ]	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

Rob Woodside, Ph.D.
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Physics 351
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Quantum Mechanics, Amit Goswami, Wm. Brown 1992 ← look at this in our grad year program.

REFERENCES: Quantum Mechanics, Dirac

Quantum Mechanics, Bohm

OBJECTIVES:

To give the student a good grounding in the fundamentals of Quantum Mechanics.

METHODS:

This course will be taught using lecture, demonstration, and computer simulations. Problems will be assigned and marked on a regular basis.

STUDENT EVALUATION PROCEDURE:

Assignments	25%
Midterm Examination	30%
Final Examination	45%

P. 11

Physics 351
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Linear vector space, operators, eigenvalues and eigenvectors.
2. Basic postulates of quantum mechanics, Schrödinger equation, probability density and flux.
3. Linear momentum, angular momentum, parity.
4. Separation of two body problem, Hydrogen atom. External magnetic and electric field.
5. Spin and spin-dependent interactions. Direct product vector spaces.
6. Pure and mixed states, polarization.
7. Stationary and time-dependent perturbation theory. Variational method.
8. Identical particles, correlations in ideal Bose-Einstein and Fermi-Dirac gases.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 381	Mathematical Physics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

The object of this course is to give the student a wide arsenal of mathematical techniques, tools and tricks to increase their ability in setting up and solving problems from scratch. The solution of partial differential equations with applications to many areas of physics is the biggest single theme of the course. Also included will be special functions, complex variable methods, calculus of variations, integral equations and a little numerical analysis at the end.

COURSE PREREQUISITES: Physics 111/112
Math 211, 212, 213, 221

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	Lecture	60 hrs	Student Directed Learning	hrs
	Laboratory	hrs		
	Seminar	hrs	Other - specify:	
	Field Experience	hrs	_____	hrs
			TOTAL	60 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

Tim Cooper
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Physics 381
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT: Advanced Mathematics for Engineers and Scientists, Murray R. Spiegel.

REFERENCES:

Integral Equations, L.G. Chambers, International Textbook.

Mathematical Physics, E. Butkov, Addison-Wesley.

Mathematical Methods of Physics, J. Mathews & R.L. Walker, W.A. Benjamin Inc.

OBJECTIVES:

1. To give students the necessary mathematical skills to tackle most common problems they will encounter in physics.

2. To give students an appreciation that mathematics really is the language of physics.

METHODS:

Lecture, Demonstration, Computer simulations. A relatively large number of assignment problems will be given.

STUDENT EVALUATION PROCEDURE:

Assignments	25%
Midterm Exam	30%
Final Exam	45%

Physics 381
NAME & NUMBER OF COURSE

COURSE CONTENT

1. A large orientation assignment will be given covering the first six chapters of the text which covers material students should know from the prerequisites for the course. Followed by review lectures if needed.

Course continues with:

2. Fourier Series

3. Fourier Integrals

4. Special Functions I (Gamma, Beta, Ei, Si, Erf)

5. Special Functions II (Bessel Functions, cylindrical & spherical; Polynomials, Legendre, Hermite & Laguerre)

6. Partial differential equations, separation of variables, Laplace Transform techniques, Sturm-Lioville systems, eigenvalues, eigenfunctions

7. Complex variables, contour integrals & Cauchy's theorem, application to evaluation of integrals

8. Calculus of Variations (with and without constraint)
Discussion of minimum action principles in physics

9. Integral Equations, Green Functions and Dirac delta-function techniques

10 Numerical methods for quadratures and solving integral and differential equations. Richardsonian techniques will be discussed.

P.15

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: NATURAL SCIENCE DATE: Fall 1992

Physics 382	~~General Laboratory~~ Modern Phys. Lab.	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

An eclectic laboratory course designed to give students a chance to perform many traditional and novel experiments. The students will be presented with a list of experiments spanning the many disciplines of physics: dynamics, optics, solid state physics, fluid dynamics, thermodynamics, electricity, magnetism, electronics, nuclear physics, etc. From this list, the students select seven experiments which they find interesting.

COURSE PREREQUISITES: Physics 221, Physics 222, Physics 252

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	Lecture	hrs	Student Directed Learning		hrs
	Laboratory	60 hrs	Other - specify:		
	Seminar	hrs			hrs
	Field Experience	hrs	TOTAL	60	HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC	TBD
SFU	TBD
UVIC	TBD
Other	

G. McGuire
COURSE DESIGNER

J.D. TUNSTALL Ph.D.
DEAN OF ACADEMIC STUDIES

Physics 382
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:
Assorted Bibliography

OBJECTIVES:

General Objectives:

1. To increase the students' appreciation that the test of all knowledge should be an experiment, and that experiments are the sole judge of the correctness of knowledge.
2. To provide the students with a chance to form and answer their questions experimentally.
3. To provide direct experience of the fundamental difference between science and other academic disciplines by demonstrating and providing experience with the way knowledge is gathered and maybe more importantly to know how you know what you know.

Specific Objectives:

1. To ensure the students have used the standard measuring devices found in most modern physics labs.
2. To provide opportunities for the students to measure and to check if the classroom theory is reproducible in the lab.
3. To provide an opportunity for students to try some simple research projects.
4. To increase the students' laboratory skills in an effort to make the students more employable.
5. To ensure the students understand the importance of being able to communicate their findings in a clear and consistent manner. To provide practice in this type of communication.

METHODS:

1. The student will be required to do seven (7) experiments from a suggested list of about eighteen (18). The suggested experiments will cover a wide cross section of the standard physics disciplines: mechanics, electricity, magnetism, optics, thermal, solid state physics, electronics, etc.
2. The students will work in pairs or individually.

Physics 382
NAME & NUMBER OF COURSE

STUDENT EVALUATION PROCEDURE:

1. The majority of marks earned (75%) in this course will be derived from the accumulated grades assigned to the individual laboratory reports.

2. The students will be required to give a seminar in which they will discuss the theory and present their data. This seminar will be worth 25% of the final grade assigned. It is expected that the marks earned in this course will be higher than those earned in a normal classroom environment.

EXPERIMENTS (Suggested) Choose 7 from list.

1. Determine the numerical value for the Gravitational constant G. (Cavendish apparatus)
2. Measuring the acceleration due to gravity. (Kater's Pendulum)
3. Millikan Oil Drop Experiment
4. Measuring the speed of light. (rotating mirrors)
5. Franck-Hertz Experiment
6. Photoelectric Effect
7. Plotting of Magnetic Fields (3D)
8. Ferromagnetism (Hysteresis)
9. Mechanical Equivalent of Heat
10. Angular Momentum (Advanced PSSC)
11. Viscous Flow through tubes
12. Doppler Effect
13. Impedance of Loudspeakers
14. Nuclear Magnetic Resonance
15. Index of Refraction of Air (Interferometer)
16. Zeeman Effect
17. Black Body Radiation
18. Individual Research Projects

- Experiments chosen to include all 6, the Third in courses.
- examinations ?

Could these be placed in second year.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 29/10/92

Math 302	Analysis of experimental and observational data	4
NAME & NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CRED.**

CATALOGUE DESCRIPTION:
A practical course on the use and understanding of linear models, based on a major statistical software package. The emphasis throughout is on the construction and interpretation of simple linear models used to represent observational points fairly near the overall mean; and on understanding which model represents the alternate hypothesis and what restriction of this model represents the null hypothesis.

COURSE PREREQUISITES: Math 106, or Math 270, or Math 104 with a grade of at least B-, or permission of the department.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE 45	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY 30	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 75	HRS

UCFV CREDIT TRANSFER	X	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curriculum Committee
COURSE DESIGNER

M.1

MATH 302: Analysis of Experimental & observational data
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: Math 330, Math 350, Math 390.	RELATED COURSES: none

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT:
Kleinbaum/Kupper/Muller, Applied regression analysis (2nd edition), Prentice-Hall.

OBJECTIVES:
The course is designed to enable students to:

1. understand the application of the simple mathematical linear model to the variety of practical problems encountered during the course;

2. understand the ubiquity of the linear model in classical statistics;

3. have some appreciation of the limitations of such models, especially for values distant from the means;

4. be confident in their own use of computer software to implement these techniques;

5. complete a simple personal research project applying at least one of the methods learnt during the course to the solution of a real-data problem.

STUDENT EVALUATION:

Project	10%
Assignments	20%
In-class tests	30%
Final Examination	40%

COURSE CONTENT:
Introduction to regression: review of simple linear least-squares regression. Multiple linear regression, explanation of the software output, interpretation of the estimated equation,

MATH 302: Analysis of Experimental & observational data
NAME & NUMBER OF COURSE

COURSE CONTENT (contd):
the coefficient of determination, inference for coefficients, the residual variance, prediction means, prediction points, the ANOVA table, the appropriate degrees of freedom (DF), the sequential sums of squares, F-tests.

Checking assumptions: examination of residuals, Q-Q plots, outliers, points of influence, auto-correlation. Approximate means and variances. Approximate transformations to normality.

Correlation: test that the (partial) correlation coefficient is zero. Discussion of Fisher's z-transform.

Indicators: Use of indicator or dummy variables to represent categories.

The one-way experimental design: application of multiple regression to the analysis of one-way experimental designs. The problem of multiple comparisons. Discussion of the Scheffe, Tukey and Bonnferroni methods. Test of linearity when multiple observations are available at each 'x' value.

The general linear model: review of matrix notation, vectors, transpose, transpose of products. In matrix notation, the general linear model, the normal equations, the sum of squares and its partitioning.

Simple experimental designs: Paired experimental designs. The randomised block design; its purpose and analysis.
The two-way factorial design; the additive model; interaction; replication. The interpretation of interaction. the unbalanced two-way design. Comparison of simple regression lines. Simple analysis of covariance in one-way designs; adjusted means, and related inference.

Frequency data: analyses of frequency data by weighted regression (the GSK approach) using asymptotic chi-squared approximations. The test for assigned probabilities, the test for independence in contingency tables, correlated binomials, McNemar's test. Simple test of an assigned distribution, based on grouped data, the goodness-of-fit test. Logistic regression. The chi-square index of dispersion for Poisson or binomial data.

Ranking methods: replacement of observations by comparative ranks, use of standard least square methods using estimate of residual variance under null hypothesis, leading to the Mann-Whitney and Kruskall-Wallis asymptotic approximations. The Wilcoxon paired rank test.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 06/01/93

Math 308	Linear Programming	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: An introduction to the theory and applications of linear programming. Topics include: the geometry of linear programs, duality, the simplex method, networks, applications of duality.

COURSE PREREQUISITES: Math 221 or Math 114. A C+ or better or recommended in Math 114.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE 60	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Cirr. Committee.
COURSE DESIGNER

M.4

Math 308 Linear Programming
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES: Math 343

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:Linear Programming, V. Chvatal and W.H. Freeman.

OBJECTIVES: The student will be provided with the resources to recognize, set up and solve linear programming problems as they occur in the sciences, economics, business, and other areas. The course will be primarily lecture-based, with some use of micro-computer resources for several assignments.

STUDENT EVALUATION PROCEDURE:

Students will write 2 to 3 midterm exams during the semester, as well as a cumulative final exam. They will also be expected to turn in assignments periodically. The approximate weightings will be as follows:

Midterm exams 40%
Final exams 40%
Assignments 20%

Math 308 Linear Programming
NAME & NUMBER OF COURSE

COURSE CONTENT:

(1) Introduction

- (a) Optimization and mathematical programming
- (b) Linear programming - formulation
- (c) The geometry of linear programs

(2) Mathematical Prerequisites

- (a) Linear Algebra
- (b) Convex sets

(3) Duality Theory

- (a) An example of dual linear programs
- (b) Transformations among various forms of the linear program
- (c) The dual problem and its properties
- (d) The duality theorem
- (e) Complementary slackness

(4) The Simplex Method

- (a) Extreme points and basic feasible solutions
- (b) The optimality theorem
- (c) Pivoting to a new basic feasible solution
- (d) Degeneracy and cycling. Multiple optima
- (e) Computational aspects
- (f) Geometric interpretation
- (g) Artificial variables and the two-phase method
- (h) The revised simplex method
- (i) The dual simplex method
- (j) Computation comparisons among the various versions of the simplex methods

(5) Case Problems

(6) Postoptimality Problems

- (a) Sensitivity Analysis
- (b) Parametric programming

(7) Special Linear Programs

- (a) The transportation problem
- (b) The transportation algorithm
- (c) Network flows

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE:10/01/93

MATH 316: NUMERICAL ANALYSIS 4
NAME & NUMBER OF COURSE DESCRIPTIVE TITLE UCFV CREDIT

CATALOGUE DESCRIPTION:
Discussion, construction and application of numerical computing solutions to mathematical problems, inc. linear algebra and eigenvalues, differentiation and integration, non-linear equations, the approximation of functions and ordinary differential equations.

COURSE PREREQUISITES: Math 112 or 114, Math 221 and knowledge of a programming language acceptable to the department.

COREQUISITES: -

HOURS PER TERM FOR EACH STUDENT				
	LECTURE	45 HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	30 HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL	75 HRS

UCFV CREDIT TRANSFER		UCFV CREDIT NON-TRANSFER		NON-CREDIT	
	X				

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curr. Committee
COURSE DESIGNER

M.8

MATH 316: NUMERICAL ANALYSIS
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Text TBA.

Basic references:

Germund Dahlquist & Ake Bjork, Numerical methods. Prentice-Hall (1974)

C.F.Gerald and P.O.Wheatley, Applied Numerical analysis (4th edition). Addison-Wesley (1989).

Burden & Faires, Numerical analysis (4th edition). Nelson (Wadsworth)

OBJECTIVES:

1. Understand the inherent limitations of floating point representation and machine accuracy, and the notion of a condition number for both a given problem and for a particular algorithm.

2. Become aquainted with the mathematics of some of the basic 'classical' techniques for finding solutions to numerical problems.

3. Know how to proceed to write appropriate software algorithms and how to use a software package pertaining to the programming language known (e.g. Borland's Numerical Methods, NAG and IMSL routines.)

STUDENT EVALUATION PROCEDURE:

Assignments	20%
In-class tests	40%
Final Examination	40%

MATH 316: NUMERICAL ANALYSIS
NAME & NUMBER OF COURSE

COURSE CONTENT:

Overview of methods: iteration (x = g(x)), local approximation, Newton-Raphson, the secant method, linear interpolation, numerical integration by the trapezoidal rule, Richardson extrapolation, approximate solution of differential equations by Euler's method, differences, simulation, algorithms, numerical instability.

Error: sources, absolute and relative, rounding and truncation, propagation, cancellation of terms, of error. Floating and fixed point representation of numbers. The condition number for the algorithm, for the problem.

Numerical use of series: alternating series, power series, acceleration of convergence, Euler-Maclaurin's summation formula, Aitken extrapolation, asymptotic series.

Approximation of functions: linear, polynomial interpolation, Lagrange's formula, inverse interpolation, equidistant interpolation and the Runge phenomenon, Chebycheff abscissae, orthogonal polynomials, economized power series, rational functions, splines; use of trigonometric series and transforms (if time allows).

Numerical linear algebra: Gaussian elimination, pivoting strategies, LU-decomposition, inverse calculation, iterative methods; symmetric positive-definite matrices, large sparse systems, eigenvalues.

Numerical integration: the rectangle rule, the trapezoidal rule and Romberg's method, Simpson's formula; singularities, infinite intervals, the Euler-Maclaurin summation formula, Stirling's asymptotic formula for ln(m!), Gaussian quadrature.

Differences, numerical differentiation.

Non-linear equations: Bisection, secant, Newton-Raphson, x = g(x) where g(x) is a contraction mapping, Aitken extrapolation. Multi-dimensions, the Nelder-Mead simplex method (as time allows).

Initial value problems: Euler's method with repeated Richardson extrapolation, the modified midpoint, power-series, and Runge-Kutta methods; predictor-corrector methods, stiff problems.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 07/01/93

Math 320	Advanced Calculus	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: An introduction to some techniques of real analysis. Topics include infinite series, uniform convergence, Taylor series, improper integrals, and Fourier Series.

COURSE PREREQUISITES: Math 214.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	LECTURE 60	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER		UCFV CREDIT NON-TRANSFER		NON-CREDIT	
	3				

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Cirr. Committee
COURSE DESIGNER

M.11

Math 320, Advanced Calculus
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:None	RELATED COURSES: Math 322

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS:Methods of Real Analysis, R. Goldberg, Wiley & Sons.

OBJECTIVES:To introduce the students to some of the series-based methods of analysis, as they are used within physics, engineering and mathematics.

STUDENT EVALUATION PROCEDURE: The students will be evaluated on the basis of assignments (approx. 20%), 2 or 3 midterm exams (aprrox.40%) and a final exam (approx.40%).

Math 320, Advanced Calculus.
NAME & NUMBER OF COURSE

COURSE CONTENT

1. Infinite Series
   a) Convergence, absolute and conditional.
   b) Series with non-negative terms, comparison tests.
   c) Ratio and root tests. Remainders.
   d) Series with variable signs.
   e) Other tests for convergence.

2. Sequences and series of functions, Uniform convergence.
   a) Uniform convergence.
   b) Consequences of uniform convergence
   c) Abel's and Dirichlet's tests.

3. Taylor Series
   a) Power series, Interval of convergence.
   b) Properties of power series.
   c) Taylor and Maclaurin series.
   d) The arithmetic of power series.

4. Improper Integrals.
   a) Conditional and absolute convergence.
   b) Improper integrals with non-negative integrands.
   c) The Cauchy principal value.
   d) Uniform convergence and consequences.

5. Fourier Series
   a) Criterion of approximations.
   b) Fourier coefficients.
   c) Dirichlet conditions.
   d) Orthogonal functions.
   e) Expansion of functions.
   f) Change of interval.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 10/10/92

Math 322	Complex Variables	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION:

An introduction to complex analysis, and its applications. Topics include: Algebra and geometry of the complex plane, analytic functions, contour integration, residue theory, conformal mappings.

COURSE PREREQUISITES: Math 211

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	LECTURE 60	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

COURSE DESIGNER: Math Cirr. Committee.

MATH 322, COMPLEX VARIABLES
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: Upper level Physics and Math courses.
None.	

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT: Complex Variables and Applications, R.V. Churchill and J.W. Brown, McGraw-Hill.

OBJECTIVES: The student will be introduced to the fundamental ideas of complex analysis as they are needed in physics, engineering and mathematics itself.

STUDENT EVALUATION PROCEDURE:

Students will write 2 to 3 midterm exams during the semester, as well as a cumulative final exam. They will also be expected to turn in assignments periodically. The approximate weightings will be as follows:

Midterm exams 40%
Final exams 40%
Assignments 20%

MATH 322, COMPLEX VARIABLES
NAME & NUMBER OF COURSE

COURSE CONTENT:

An introduction to the theory and applications of complex numbers. Topics will include:

1. The complex number field (modulus, conjugate, functions, regions, n'th root of unity, the fundamental theorem of algebra.)

2. Analytic functions (Cauchy-Riemann equations, exponential functions, log function, trig. functions, branch points, harmonic functions.)

3. Curves and contour integration. (Cauchy's theorem, Cauchy's integral formula, the maximal principle.)

4. Taylor series and Laurent series, term-by-term differentiation and integration.

4. Singularities, residues and poles, the residue theorem and applications.

5. Introduction to conformal mapping. Bilinear transformations, Schwartz-Christoffel transformation (time permitting.)

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 29/10/92

Math 330	Design of Experiments.	4
NAME & NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CRED.**

CATALOGUE DESCRIPTION:

The construction and analysis of standard experimental designs. Emphasis will be on the conduct, assumptions, implications and the rationale of particular designs; not on the finite geometry nor the combinatorics of the designs. Students will use suitable software, e.g. MINTAB, BMDP, when necessary. Students will be expected to design, conduct, analyse and report an experiment illustrating at least one of the major designs discussed during the course.

COURSE PREREQUISITES: Math 302.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE 45	HRS	STUDENT DIRECTED LEARNING	- HRS	
	LABORATORY 30	HRS			
	SEMINAR	HRS	OTHER - specify:	- HRS	
	FIELD EXPERIENCE	HRS	TOTAL 75	HRS	

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curriculum Committee
COURSE DESIGNER

M.17

MATH 330: Design of Experiments.
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: none

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT: TBA
Basic References:

Statistics for experimenters. G.E.P.Box, W.G.Hunter, J.S.Hunter (John Wiley & Sons 1978)

The design and analysis of clinical experiments. Joseph L. Fleiss (John Wiley & Son 1986)

Analysis of repeated measures. M.J.Crowder & D.J.Hand (Chapman and Hall 1990).

The design of experiments. D.R.Cox. (John Wiley & Sons 1957).

OBJECTIVES:

The course is designed to enable the students to:

1. be familiar with the basic statistical designs commonly met in practice and in the literature;

2. understand the reasoning and importance of the basic experimental manoeuvres of randomisation, blocking, stratification, and replication;

3. meet the notion of random effects models for the first time;

4. consider the effects of measurement errors in the independent variables and the notions of replicability and reliability.

STUDENT EVALUATION PROCEDURE:

Project	10%
Assignments	20%
In-class tests	30%
Final Examination	40%

MATH 330: Design of Experiments.
NAME & NUMBER OF COURSE

COURSE CONTENT:

Linearity: the assumptions of a linear model, linear effects and a linear error. Randomization.

Blocking designs: matched pairs; randomisd blocks; latin Squares; multiple latin squares; graeco-latin squares; balanced incomplete block design, Youden squares.
Blocking versus covariate analysis - discussion.

Factorial designs: 2^N designs. Yates' plussing and minussing; Daniels' method of normal plotting to select contrasts of interest in saturated designs. Fractional factorial (f.f.) designs, confounding and aliasing. How to select a f.f. design; implications of the selection; replication.
Designs of Resolution R.
Plackett & Burman designs.

Response surface methods: use and estimation of local quadratic approximations, search for optimum.

Variance components: variance component models in balanced designs, construction of appropriate models, interpretation of tests, confidence intervals for fixed effects.

Cross-over designs: conditions under which they are appropriate, analysis and interpretation.

Split-plot designs: common repeated measure designs, and corresponding univariate models and analysis.

Error-in-measurement problems: replication and reliability; Cronbach's alpha; the attentuation of slope estimates.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 10/10/92

Math 343	Applied discrete mathematics	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CRED.

CATALOGUE DESCRIPTION: An introduction to discrete modelling, generation of combinatorial objects, applications to scheduling, applications of graphs.

COURSE PREREQUISITES: Math 243, Knowledge of a computing language (Fortran, or PL/1).

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	LECTURE 60	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60 HRS	

UCFV CREDIT TRANSFER	3	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC: TBA

SFU: TBA

UVIC: TBA

Math Cirr. Committee.
COURSE DESIGNER

Math 343, Applied Discrete Mathematics
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: none	RELATED COURSES: Upper level computing courses.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: TBA

OBJECTIVES:This course is a survey of some combinatorial aspects of computing. Students will study algorithms for enumeration, optimization and other discrete problems, and their implementation on a computer. Issues of complexity will also be discussed. Some of the assignments will require use of computer resources.

STUDENT EVALUATION PROCEDURE: Students will be evaluated on the basis of two or three in-class exams (approx. 40%), a final exam (approx. 40%) and assignments (approx. 20%.) Some of the assignments will require computer resources.

MATH 343 APPLIED DISCRETE MATHEMATICS
NAME & NUMBER OF COURSE

COURSE CONTENT: Topics will include the following items in sections 1,2 and 3, and selected items from sections 4,5 and 6.

1. Concepts of combinatorics and graph theory. (Combinations, permutations, partitions, networks, paths, cycles.) Enumeration of these objects.

2. Computer representation of combinatorial objects. (Representations of integers, sets, graphs, networks etc.)

3. Complexity of Combinatorial computations. (Computational efficiency, polynomial-time algorithms, recognition problems, the satisfiability problem, Cook's theorem, Karp's reductions.)

4. Basic Techniques. (Searching in trees, backtracking, generation of combinations, permutations. Partitions of a set. Sieving processes and isomorph rejection. Enumeration. Sorting problems.)

5. Shortest paths and flows in networks. (Max-flow min-cut theorem. The labelling problem. Methods of finding shortest paths, the Belman-Ford algorithm, Dijkstra's algorithm, the Floyd-Marshall method. Minimal cost flow problems, the Hitchcock problem; applications.)

6. Other algorithms. (Graph colouring, backtracking, impasse detection. Hamilton path generation. The travelling salesman problem. Determination of connectivity, components, and spanning trees. Matching problems)

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 29/10/92

Math 350	Survey Sampling	4
NAME & NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CRED.**

CATALOGUE DESCRIPTION:

An introduction to the theory and practice of survey sampling. Students will be expected to draw up a sampling frame, design, conduct, analyse and report a small sample survey.

COURSE PREREQUISITES: Math 302; Math 270 recommended.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE 45	HRS	STUDENT DIRECTED LEARNING	- HRS	
	LABORATORY 30	HRS			
	SEMINAR	HRS	OTHER - specify:	- HRS	
	FIELD EXPERIENCE	HRS	TOTAL 75	HRS	

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

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TBA

Math Curriculum Committee
COURSE DESIGNER

Math 350: Survey Sampling
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: none

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXT: TBA

Basic References:

Survey sampling. L.Kish (John Wiley & Sons, 1965)

Statistical design for research. L.Kish (John Wiley & Sons, 1987)

Sampling techniques (third edition). W.G.Cochran (John Wiley & Sons, 1977)

OBJECTIVES:

The course is designed to enable students to:

1. have a basic understanding of the practical requirements necessary to undertake a sample survey;

2. appreciate the particular mathematical viewpoint of the theory of sampling from a finite population, and the differences this forces upon certain mathematical definitions and procedures;

3. be acquainted with the standard sampling designs and nomenclature, and the customary formulas used to analyse the results.

STUDENT EVALUATION PROCEDURES:

Project	10%
Assignments	20%
In-class tests	30%
Final Examination	40%

Math 350: Survey Sampling
NAME & NUMBER OF COURSE

COURSE CONTENT:

Simple random sampling: variances, the finite population correction, the standard error, random sampling with replacement, estimation of a ratio, estimates of totals over subpopulations, comparison between domain means.

Sampling proportions and percentages: estimation of proportions in cluster sampling.

Estimation of sample size: the design effect, deff.

Stratified random sampling: proportional and optimal allocation.

The ratio estimator: variance, bias, coefficient of variation, comparison of two ratios, the regression estimator.

Single-stage cluster sampling: equal sized clusters, intraclass correlation, p.p.s. sampling.

Specific techniques: including two-stage sampling, interpenetrating subsamples, repeated measurement. Practical problems: including non-response.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE:10/01/93

MATH 370: METHODS OF MULTIVARIATE STATISTICS 4
NAME & NUMBER OF COURSE DESCRIPTIVE TITLE UCFV CREDIT

CATALOGUE DESCRIPTION:
The basis of the course is the extension of the linear model methods of MATH 302 to the multi-variate situation. The emphasis of the course is on examination of a range of widely used multivariate statistical techniques, their relationship with familiar univariate methods and on the solution to practical problems. 'The entire theory of multivariate tests of significance by analysis of dispersion is obtained as a generalization of the univariate analysis of variance', C.R. Rao (1973).

COURSE PREREQUISITES: Math 221, 270, 302.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE	45 HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	30 HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL	75 HRS

UCFV CREDIT TRANSFER	X	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curr. Committee
COURSE DESIGNER

M.26

Math 370: Methods of Multivariate statistics
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: Upper level Statistics courses.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Text TBA.

Basic references:

Rao, C.R. (1973) Linear statistical models, Chapter 8. John Wiley & Sons.

Timm, Neil H : 'Multivariate analysis of variance of repeated measures' In P.R.Krishnaiah, ed, Handbook of Statistics: Analysis of variance; Volume 1, pages 41-87, Amsterdam, North-Holland Publishing Company (1980).

Berhard Flury and Hans Riedwyl (1985), 'T^2 Tests, the linear two-group discrimination function and their computation by linear regression', The American Statistician Vol 39, pages 20-25.

OBJECTIVES:

1. Understand how a sound grasp of the univariate linear model can be simply developed into an intuitive understanding of the commonly used multi-normal statistical techniques.

2. Be conversant with the commonly used multivariate statistical methods and how to apply them to data sets using statistical software.

3. Become aquainted with the major multi-variate criteria for the comparison of competitive hypotheses, and inter-relationships of these criteria.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
In-class tests	40%
Final Examination	40%

Math 370: Methods of Multivariate statistics
NAME & NUMBER OF COURSE

COURSE CONTENT:

Expectation, dispersion and covariance of vector random variables.

The general multivariate normal distribution, its marginal and conditional distributions and properties.

Estimation of μ, and Σ; the sums of squares and cross-products matrices. Sampling and the use of the basic results on the Wishart distribution, the distribution of special cases of the Wilks' lambda criterion and of Hotelling's T^2.

Tests for assigned mean values, for a given structure of mean values, for differences between mean values of two populations. Fisher's linear discriminant. Relationship between linear discriminant analysis and linear regression. Mahalanobis' D^2.

The Analysis of Dispersion, tests of linear hypotheses, test for additional information. Test for differences in mean values between several populations.

Multivariate regression
Repeated measures, growth curves.

Discussion of criteria and their relationships, Wilks' lambda, Hotelling-Lawley trace, Roy-Pillai largest root.

Discriminant analysis, the equivalent discriminant score.

Canonical correlations. Canonical discriminant functions. Principal components - use of covariance and correlation matrices.

The ideas underlying factor analysis; the principal factor method. More modern factor analysis methods illustrated by the use of appropriate software.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 29/01/93

NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CRED.
Math 390	Time series & forecasting	4

CATALOGUE DESCRIPTION:
The course is an introduction to the basic ideas on time series analysis and to the Box-Jenkins ARIMA family of models in particular. Observations are assumed discrete and uniformly spaced. Spectral methods are discussed without mathematical depth. The emphasis of the course will be on practical implementation of the methods. Students will have access to software implementing these models, e.g. MINITAB and BMDP. Students will be expected to collate a time series of their own choice, appropriately analyse, report, and construct forecasts for it.

COURSE PREREQUISITES: Math 270, 302.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE 45	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY 30	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 75	HRS

UCFV CREDIT TRANSFER	X	UCFV CREDIT NON-TRANSFER		NON-CREDIT	

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curriculum Committee
COURSE DESIGNER

M.29

Math 390: Time series & forecasting
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: none

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)
TEXT: TBA

Basic References:

Time series analysis, forecasting and control. G.E.P.Box and G.W.Jenkins. (Prentice-Hall, Inc. revised edition 1976)

Quantitative forecasting methods. N.R.Farnum and L.W.Stanton. (PWS-KENT Publishing Company, Boston, 1989)

OBJECTIVES:

The course is designed to enable students to:

1. become acquainted with the theoretical and practical difficulties associated with correlated observations, and the standard procedures for analysis of such data;

2. become familiar with ARIMA models and how to use appropriate software to fit these models to data;

3. understand the relation of widely used empirical techniques to the mathematical ARIMA models and spectral methods;

4. be able to construct probabilistic forecasts from time series data.

STUDENT EVALUATION PROCEDURE:

Project	10%
Assignments	20%
In-class tests	30%
Final Examination	40%

Math 390: Time series & forecasting
NAME & NUMBER OF COURSE

COURSE CONTENT:

First notions: methods for forecasting, differencing, regression, moving averages, Fourier methods, Schuster's periodogram, updating, Holt-Winters' exponentially weighted moving averages, seasonality.

Stationarity: the autocorrelation function, the spectral density function, estimates, variances, smoothing.

Linear random shock models: the autoregressive moving average models, the Yule-Walker equations, admissability and invertibility, differencing.

Minimum mean square error forecasts: stochastic model building and identification, diagnostic checking, moitoring forecasts.

Seasonal forecasting: simple models.

Linear transfer function models: the cross-correlation function, simple models relating two series.

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE:10/01/93

MATH 402:Generalised linear models and survival analysis. 4
NAME & NUMBER OF COURSE DESCRIPTIVE TITLE UCFV CREDIT

CATALOGUE DESCRIPTION:
The application of the methods of the linear model analysis developed in Math 302 to non-normal data. This includes, in particular, the analysis of contingency tables by log-linear models, the analysis of incidence data by Poisson models, the analysis of case-control data by logistic models, the analysis of matched case-control data by conditional logistic regression, and the analysis of survival data adjusting for covariates and by the use of Cox's proportional hazard models.

COURSE PREREQUISITES: Math 302, and Math 270 or permission of the department.

COURSE COREQUISITES:

HOURS PER TERM FOR EACH STUDENT	LECTURE	45 HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	30 HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL	75 HRS

UCFV CREDIT TRANSFER	[X]	UCFV CREDIT NON-TRANSFER	[ ]	NON-CREDIT	[ ]

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC
TBA

SFU
TBA

UVIC
TBA

Math Curr. Committee
COURSE DESIGNER

M.32

MATH 402:Generalised linear models and survival analysis.
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE:	RELATED COURSES: Upper level Statistics courses, esp. Math 302, Math 370.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Text TBA.

Basic references:

McCullagh, P. and Nelder, J.A. Generalized Linear Models (Second edition). Chapman and Hall (1989).

Dobson, A.J. (1983) An introduction to statistical modelling. Chapman and Hall (1983).

Kalbfleisch, J.D. and Prentice, R.L. The statistical analysis of failure time data. John Wiley (1980).

OBJECTIVES:

1. Understand how a sound grasp of the univariate linear model can be extended by the use of the Nelder-Wedderburn methods to a large variety of exponential models with a scale factor.

2. Be conversant with the commonly used generalised linear model applications and how to apply them to data sets using statistical software.

3. Become aquainted with the notions underlying the published analyses of incidence and survival data, especially the 'lack of memory' of the Poisson model and of the Cox conditional likelihood.

STUDENT EVALUATION PROCEDURE:

Assignments	20%
In-class tests	40%
Final Examination	40%

MATH 402:Generalised linear models and survival analysis.
NAME & NUMBER OF COURSE

COURSE CONTENT:

Dilution assays, the complementary log-log transformation. Probit analysis. Logit models for proportions. Inverse polynomials.

Weighted regression, deviance, the link function, exponential models with a scale factor, the Nelder-Wedderburn scoring method of iteratively reweighted least squares with an iteratively adjusted dependent variable.

Special cases with discussion:
Exponential failure with covariates, simple survival.
Poisson counts with covariates, application to incidence data, repeated counts of a single observation.
Analysis of multi-way contingency tables by log-linear models.
Logistic regression.
Conditional logistic regression; application to matched case-control data.
Models with constant coefficient of variation, the gamma distribution.
The inverse-Gaussian distribution, applications to length-of-stay data.

Weibull survival with covariates.
Extreme value distribution with covariates.
Cox's proportional-hazard model, Cox's logistic model for survival. Stratification.

Examples of joint modelling of mean and dispersion (as time allows).

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DEPARTMENT: Mathematics DATE: 05/01/93

Mathematics 439	Modern Algebra	3
NAME & NUMBER OF COURSE	DESCRIPTIVE TITLE	UCFV CREDIT

CATALOGUE DESCRIPTION: This course is an introduction to the ideas of modern algebra, with emphasis on group theory. Topics include groups and symmetry, group structure (Sylow theorems, finite Abelian groups) and group actions. The basic elements of ring theory (ideals and homomorphisms, integral domains, polynomial rings, unique factorization) and field theory (characteristic, algebraic extensions) are also considered.

COURSE PREREQUISITES: Math 221

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT				
	LECTURE 60	HRS	STUDENT DIRECTED LEARNING	- HRS
	LABORATORY	HRS		
	SEMINAR	HRS	OTHER - specify:	- HRS
	FIELD EXPERIENCE	HRS	TOTAL 60	HRS

UCFV CREDIT TRANSFER	UCFV CREDIT NON-TRANSFER	NON-CREDIT
3		

TRANSFER STATUS (Equivalent, Unassigned, Other Details)

UBC TBA

SFU TBA

UVIC TBA

Math Cirr. Committee.

M.35

MATH 439 MODERN ALGEBRA
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: None	RELATED COURSES:

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: A first course in Abstract Algebra, Fraleigh, (Addison-Wesley)

OBJECTIVES: The student will be introduced to some of the core ideas of modern algebra, an important field in contemporary mathematics. The group theory portion will provide the student with sufficient background to understand and use groups as they are applied in physics and chemistry.

STUDENT EVALUATION: The students will be evaluated on the basis of midterm exams (approx. 40%), a final exam (approx. 40%) and assignments (approx 20%.)

MATH 439 MODERN ALGEBRA
Name & Number of Course

COURSE CONTENT:

(1) Brief review:

- (a) Sets and subsets
- (b) Injections, surjections, etc.
- (c) Quotient structures
- (d) Elementary number theory (prime numbers, congruences.)

(2) Introduction to groups:

- (a) Binary operations
- (b) Groups in mathematics: Symmetry, matrices, the integers, modular arithmetic, permutations.
- (c) Group axioms
- (d) Subgroups, quotient groups, first isomorphism theorem.
- (e) Group actions

(3) Group structure:

- (a) Lagrange's theorem, Cayley's theorem
- (b) Direct products
- (c) Abelian groups (structure of finite abelian groups)
- (d) The Sylow theorems

(4) Introduction to rings:

- (a) Ideals and homomorphisms
- (b) Integral domains and quotient fields
- (c) Polynomial rings, unique factorization

(5) Introduction to fields:

- (a) Characteristic
- (b) Algebraic extensions
- (c) Finite fields