S.92-4

SIMON FRASER UNIVERSITY

MEMORANDUM

To:	Senate	From:	J.M. Munro, Chair Senate Committee on Academic Planning
Subject:	Faculty of Applied Sciences Graduate Curriculum Revisions	Date:	December 10, 1991

Action undertaken by the Senate Committee on Academic Planning and the Senate Graduate Studies Committee, gives rise to the following motion:

Motion: "that Senate approve and recommend approval to the Board of Governors as set forth in S.92-4 graduate curriculum revisions in the Faculty of Applied Sciences as follows:

i) S.92-4a School of Computing Science
ii) S.92-4b School of Engineering Science
iii) S.92-4c School of Resource and Environmental Management"

S.92-4a

School of Computing Science

Summary of Graduate Curriculum Revisions

SGSC Reference: Mtg. of November 25, 1991

SCAP Reference: SCAP 91-44

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1. Change to the Computing Science Ph.D. Research regulations.

1. New Regulations — Research Section, the Degree Requirements for the Ph.D. Program

The modified Research Section of the Degree Requirements for the Ph.D. Program is as follows. The original articles, 4(a) and 4(b), are modified and merged into one article, 4(a). For other sections, see pp. 224–227, Simon Fraser University Calendar, 1990–1991.

Section 4. Research

The major portion of the Ph.D. program consists of original research under the direction of a Supervisory Committee. A Ph.D. Supervisory Committee consists of a Senior Supervisor, at least one other faculty member from the School of Computing Science, and other committee members as appropriate.

(a) The student is required to pass an oral Ph.D. Preliminary Examination. The student is required to submit before the exam a written Research Review and Proposal which should consist of a survey of the proposed research area, a summary of his/her preliminary research results, and a proposal for further research. The student must demonstrate that he/she possesses both the ability and adequate knowledge of the chosen research area to pursue and complete original research at an advanced level. Moreover, he/she should demonstrate some preliminary research results related to the proposed research. The proposal should be appropriate in level and scope for a Ph.D. thesis. The Supervisory Committee must be satisfied with the preliminary research results and the research proposal of the candidate. The Ph.D. Preliminary Examination is conducted by the student's Supervisory Committee under the arrangement of the Graduate Program Committee, and should normally take place within one year after the student has satisfied the Breadth Requirement. In case the student cannot take the Examination within the specified period of time, he/she can request for one year extension, in writing, to the student's Supervisory Committee. A student must pass the Ph.D. Preliminary Examination within two years after he/she has satisfied the Breadth Requirement.

(b) The student is required to present a seminar based on his/her thesis research. This seminar is normally presented a few weeks before the candidate's thesis defense.

(c) The student is required to submit and defend a thesis based on substantial original research. For regulations governing the composition of a Ph.D. Examining Committee and the conduct of Ph.D. Thesis Examinations, see Sections 1.9 and 1.10 of the *Graduate General Regulations*.

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4. Research

The major portion of the Ph.D. program consists of original research under the direction of a Supervisory Committee. A Ph.D. Supervisory Committee consists of a Senior Supervisor, at least one other faculty member from the School of Computing Science, and other committee members as appropriate.

(a) The student is required to pass a Research Area Examination in his/her chosen research area. The student must demonstrate that he/she possesses both the ability, and adequate knowledge of the chosen research area, to pursue and complete original research at an advanced level. The Research Area Examination is conducted by the student's Supervisory Committee and should normally take place within six months after the student has satisfied the Breadth Requirement.

(b) The student is required to submit a written Research Proposal to the School for approval by the student's Supervisory Committee. The Supervisory Committee must be satisfied that the proposed research is appropriate in level and scope for a Ph.D. thesis.

(c) The student is required to present a seminar based on his/her thesis research. This seminar is normally presented a few weeks before the candidate's thesis defence.

(d) The student is required to submit and defend a thesis based on substantial original research. For regulations governing the composition of a Ph.D. Examining Committee and the conduct of Ph.D. Thesis Examinations, see Sections 1.9 and 1.10 of the *Graduate General Regulations*.

For further information and regulations for both the M.Sc. and Ph.D. degrees, refer to the *Graduate General Regulations*.

2.

Message: 3612790, 19 lines
Posted: 5:48pm PST, Mon Nov 25/91, imported: 5:48pm PST, Mon Nov 25/91
Subject: Calendar Change Justification
To: Bruce Clayman
Cc: burton@cs.sfu.ca
From: burton@cs.sfu.ca

Here is some further justification for the proposed change to the Ph.D. Research regulations in Computing Science, approved at the Senate Grad Studies Committee meeting earlier today.

The proposed change to the Computing Science Ph.D. Research regulations combines two research requirements into one. At present there is an oral Research Area Examination that is designed to test the student's knowledge of his or her chosen research area. There is also a requirement for a Research Proposal. Often the student will meet with the Supervisory Committee at the time the Proposal is submitted. There is some confusion, on the part of both students and faculty, on where the line should be drawn between the research area and the research topic. By combining these requirements into one, the confusion is removed, the research area may be examined in light of a more specific research proposal, and one "stage" is removed from the Ph.D. process.

S.92-4b

School of Engineering Science

Summary of Graduate Curriculum Revisions

SGSC Reference: Mtg. of November 25, 1991

SCAP Reference: SCAP 91-45 and SCAP 91-46

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1. New course ENSC 890 - 3, Advanced Robotics: Mechanics and Control
2. Calendar editorial changes
3. Change defining the M.Eng. degree requirements.
4. Changes to qualifying examinations

SIMON FRASER UNIVERSITY

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: School of Engineering Science **Course Number:** ENSC 890

Title: Advanced Robotics: Mechanics and Control

Description: see attached

Credit Hours: 3 **Vector:** 3-0-0 **Prerequisite:** ENSC 438, 801 or permission of instructor

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 10 **When will the course first be offered:** Spring 1993

How often will the course be offered: Once a year or upon sufficient demand

JUSTIFICATION:

Increased application of robot manipulator require better approaches for their modelling and control. This course discusses such approaches and presents examples of advanced robotics applications.

RESOURCES:

Which Faculty member will normally teach the course: Shahram Payandeh

What are the budgetary implications of mounting the course: No additional faculty or staff is required.

Are there sufficient Library resources (append details): yes

Appended:
a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved:
Departmental Graduate Studies Committee: [signature] Date: July 15 1991
Faculty Graduate Studies Committee: [signature] Date: Aug. 31/91
Faculty: ________ Date: ________
Senate Graduate Studies Committee: [signature] Date: Nov 27/91
Senate: ________ Date: ________

ADVANCED ROBOTICS: MECHANICS AND CONTROL

a) *Course Outline*

1. Kinematic Geometry and Statics - 4 weeks
   - line geometry and screw systems
   - screw operator
   - kinematic modelling of robot manipulator using the theory of screw
2. Robot Dynamics and Control - 5 weeks
   - Euler-Lagrange and Newton-Euler formulations
   - independent joint control
   - multivariable control
   - adaptive control
   - contact force control
3. Grasping and Manipulation - 3 weeks
   - grasp model
   - control of grasping forces
   - grasped object manipulation
4. Advanced Robotics and Manufacturing - 1 week

b) *Instructor*

Dr. Shahram Payandeh - The major research interests and publications of Dr. Payandeh are in the areas of robot kinematics, grasping, manipulation and force control of robot manipulator(s).

c) *Library Facilities*

SFU library holds adequate number of books, journals and conference proceedings in the areas which are covered in this course. The following is a list of some of them.

- Spong and Vidyasagar, *Robot Dynamics and Control*, 1989
- McCarthy, *Introduction to Theoretical Kinematics*, 1990
- Waldron, *Advanced Robotics*, 1989
- Brady, *Robotics Science*, 1989
- Cutkosky, *Robotic Grasping and Fine Manipulation*, 1985

- Mason and Salisbury, *Robot Hand and the Mechanics of Manipulation*, 1985
- An, Atkenson and Hollerbach, *Model-Based Control of Robot Manipulator*, 1988
- IEEE Journal of Robotics and Automation
- International Journal of Robotics Research
- IEEE Transactions on Systems, Man, and Cybernetics
- IEEE Transactions on Automatic Control
- Proceedings of the IEEE International Conference on Robotics and Automation
- Proceedings of the International Symposium on Robotics Research.

CALENDAR DESCRIPTION

ENSC 890-3

The course presents advanced approaches to modelling, control and applications of robot manipulators. Topics include kinematic modelling of manipulators using the theory of screw and screw operators; methods for obtaining dynamic model of manipulators; control of manipulators based on independent joint and multivariable control approaches; control of the contact forces between a manipulator and its environment; and adaptive control of manipulators. The course also discusses modelling and control of grasping/manipulation using a dexterous end-effector. Laboratory experiments are performed to complement the control theoretic part of the course.

PREREQUISITE: ENSC 438, 801 or PERMISSION OF INSTRUCTOR

SIMON FRASER UNIVERSITY

MEMORANDUM

To: John D. Jones
Engineering Science

From: Sharon Thomas
Collections Management

Subject: New Course

Date: July 16, 1991

The proposed new course, ENSC 890: Advanced Robotics: Mechanics and Control, falls well within the Library's current collections parameters and should present no particular difficulties for us. However much of the material is already heavily used and it might be advisable to purchase additional copies of a few core titles. This could easily be done within the range of current expenditures for Engineering Science and will entail no extraordinary new obligations for the Library.

Sharon Thomas

MEMORANDUM
SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

DATE: October 25, 1991

To: Dr. Richard S. Gruneau
Chairman, Faculty of Applied Science
Graduate Studies Committee

RE: **Proposed Calendar Changes for the 1992/93 Calendar**

FROM: Dr. John D. Jones
Graduate Chairman
School of Engineering Science

Please find enclosed our proposed calendar changes for the School of Engineering Science. The rationales for these changes are as follows:

Items #1, 3 and 4

These proposed changes are editorial changes.

Item #2

This proposed change defines the M.Eng. degree requirements based on the student's specialization.

Item #5

Two changes to the qualifying examinations are proposed: firstly, the names of the latter three subjects are changed to reflect a more rational grouping of material; secondly, the number of minor exams is reduced from two to one. The former change is editorial, while the latter is substantive. Our experience has shown that, due to the diversity of the graduate options offered in engineering, and the diverse background of our graduate students, requiring students to take exams in three separate options usually results in their being obliged to study material remote from their background and irrelevant to their research. This discourages otherwise well qualified graduate students from applying to the School, and is thus inimical to the health of our graduate program.

Item #6

The proposed changes provide more detailed course descriptions.

All the changes were passed unanimously at the departmental level.

The highlighted text is new. It will replace the previous entry and in some cases it is an addition.

1. **FROM**

DEGREES OFFERED

Engineering Science offers three distinct programs of study, leading to a Master of Engineering (M.Eng.), Master of Applied Science (M.A.Sc.) or Doctor of Philosophy (Ph.D.).

TO

DEGREES OFFERED

Engineering Science offers two distinct masters degrees, Master of Engineering (M.Eng.), or Master of Applied Science (M.A.Sc.); and a Doctor of Philosophy (Ph.D.) degree.

2. **FROM**

M.ENG. Requirements

Course Work

M. Eng. candidates are required to complete a minimum of 24 semester hours course work, at least 20 of which must be at the graduate level. Of the courses listed below, ENSC 805, ENSC 810 and ENSC 820 are required.

TO

DEGREE REQUIREMENTS - M.ENG. PROGRAM

Course Work

M.Eng. candidates are required to complete a minimum of 24 semester hours course work, at least 20 of which must be at the graduate level. Of the courses listed below, students must take ENSC 820. In addition for those specializing in communications ENSC 805, ENSC 810 are required, for those in electronics, one of ENSC 851, ENSC 852 or ENSC 853 must be taken, and for students in intelligent systems and control ENSC 801 must be taken.

3. **FROM**

M.A.Sc. Requirements

M.A.Sc. candidates are required to complete 30 semester hours work as a minimum of 12 semester hours course work, plus a thesis with a weight of 18 semester hours. The courses will, in consultation with the senior supervisor, normally be selected from the list below.

TO

DEGREE REQUIREMENTS - M.A.SC. PROGRAM

M.A.Sc. candidates are required to complete 30 semester hours work as a minimum of 12 semester hours course work, plus a thesis with a weight of 18 semester hours. The courses will, in consultation with the senior supervisor, normally be selected from the list below.

FROM

Ph.D. Program

Admission Requirements

To qualify for admission to the Ph.D. program a student must have a Master's degree in electrical engineering, mechanical engineering, physics, computer science or a related field, have submitted evidence that he or she is capable of undertaking substantial original research in Engineering Science, and have identified a faculty member willing to act as Senior Supervisor.

See the *Graduate Regulations* for admission requirements for entry to the Ph.D. program.

Admission from Master's Program to Ph.D. Program

The school does not encourage students to proceed to a Ph.D. without first completing a Master's degree. However, a student may be admitted after at least 12 months in the M.A.Sc.

TO

Ph.D. Program

Admission

To qualify for admission to the Ph.D. program a student must have a Master's degree in electrical engineering, mechanical engineering, physics, computer science or a related field, have submitted evidence that he or she is capable of undertaking substantial original research in Engineering Science, and have identified a faculty member willing to act as Senior Supervisor.

See the *Graduate Regulations* for admission requirements for entry to the Ph.D. program.

Residence Requirement

Students will conform to the residence requirement as outlined in section 1.7.3 of the General Regulation.

Transfer from the Master's Program to the Ph.D. Program

The school does not encourage students to proceed to a Ph.D. without first completing a Master's degree. However, a student may be admitted after at least 12 months in the M.A.Sc.

5. **FROM**

Qualifying Examination

The student will take a qualifying examination at a time determined by his/her Supervisory Committee, normally between the 6th and the 12th month from admission to the Ph.D. program. The student must demonstrate a sophisticated understanding of material normally associated with undergraduate and first level graduate studies. There will be written examinations set in each of the following four subjects: communications, electronics, intelligent systems and control, computing.

The material for the comprehensive examinations will be determined by the departmental graduate committee. With the approval of the Supervisory Committee, students select three subject areas to be covered by examinations, as follows: one is declared a major (specialty) area and the other two are minor areas. The written examination in the major area is followed shortly by an oral examination.

Possible results of the qualifying examination are pass; marginal (student may be required to take more courses, and is permitted a second and last opportunity to take the full qualifying exam within 12 months); fail (the student withdraws from the Ph.D. program). The results are given for the full qualifying exam.

Research

Students are to define and undertake a program of original research, the results of which are reported in a thesis. The examining committee will be formed as defined in section 1.9.3 of the *Graduate General Regulations*. Students will conform to residence requirements as outlined in section 1.7.3 of the *Graduate General Regulations*. The senior supervisor shall be an Engineering Science faculty member approved by the departmental graduate program committee.

TO

Qualifying Examination

The student will take a qualifying examination at a time determined by his/her Supervisory Committee, normally between the 6th and 12th month from admission to the Ph.D. program. The student must demonstrate a sophisticated understanding of material normally associated with undergraduate and first-level graduate studies. There will be written examinations in each of the following four subjects: 1. communications, 2. microelectronics, 3. intelligent systems and computing and 4. robotics and control.

The material for the comprehensive examinations will be determined by the departmental graduate committee. With the approval of the supervisory committee, students select two subject areas to be covered by examinations, as follows: one is declared a major (speciality) area and the other a minor area. The written examination in the major area is followed shortly by an oral examination.

Outcomes of the qualifying examination are pass; marginal (student may be required to take more courses, and is permitted a second and last opportunity to take the full qualifying exam within 12 months); fail (the student withdraws from the Ph.D. program). The results are given for the full qualifying exam.

Thesis

Students are to define and undertake a program of original research, the results of which are reported in a thesis. The examining committee will be formed as defined in section 1.9.3 of the *Graduate General Regulations*. Students will conform to residence requirements as outlined in section 1.7.3 of the *Graduate General Regulations*. The senior supervisor shall be an Engineering Science faculty member approved by the departmental graduate program committee.

GRADUATE COURSES (ENSC)

FROM

ENSC 801-3 Linear Systems Theory

A comprehensive treatment of finite dimensional linear dynamical systems.

Prerequisite: Grad. Standing

TO

ENSC 801-3 Linear Systems Theory

State-space analysis of finite dimensional continuous and discrete time linear systems. Linear vector spaces, linear operators, normed linear spaces, and inner product spaces. Fundamentals of matrix algebra, induced norm and matrix measures, functions of a square matrix, Cayley-Hamilton and Sylvester's Theorems. Analytical representation of linear systems, state-space formulation, solution of the state equation and determination of the system's response. Controllability, observability, duality, canonical forms, and minimal realization concept.s Stability analysis, Lyapunov's method, and design of feedback regulators.

Prerequisite: Grad. Standing

FROM

ENSC 802-3 Stochastic Systems

This is a course in probability, random variable and stochastic processes, and the application of these theories to analyse different engineering systems.

Prerequisite: Grad. Standing and a Bachelor's degree in engineering, mathematics or physics

TO

ENSC 802-3 Stochastic Systems

This course emphasizes the application of theories in probability, random variables and stochastic processes in the analysis and modelling of engineering systems. Topics covered include a brief review of probability and random variables; random processes, autocorrelation and power spectral density; first order systems with stochastic inputs: AR and ARMA models, random walk; point processes: Poisson and renewal processes, counting process; discrete random processes: birthdeath processes, markov chains, elementary queuing theory; introduction to estimation theory: parameter estimation, linear estimation, spectrum estimation, Kalman filtering. Areas of application include digital communications, speech and image processing, control, radar, and Monte Carlo simulations.

Prerequisite: Grad. Standing

FROM

ENSC 836-3 Error Correcting Codes

Introduction to error detecting and correcting codes and their implementations.

Prerequisite: undergraduate courses in probability and discrete mathematics.

TO

ENSC 836-3 Error Correcting Codes

Topics include brief introduction to information theory; linear block codes: Cyclic Codes, BCH and Reed Solomon Codes; convolutional codes: Viterbi and sequential decoding, soft decision decoding, comparisons between block and convolutional codes: power-bandwidth tradeoff, bandwidth efficient trellis coded modulations, rotational invariant TCM; error control protocols; application of coding in fading and satellite channels, decoding complexity and implementations.

Prerequisite: undergraduate courses in probability and discrete mathematics; MATH 447; or permission of instructor.

FROM

ENSC 855-3 Passive Microwave Circuits

Review of electromagnetic theory, transmission lines and waveguides, passive microwave circuit analysis, filters couple lines and directional couplers.

Prerequisite: Grad. Standing

TO

ENSC 855-3 Passive Microwave Circuits

Review of Electromagnetic principles. Application of S-parameters. Technology of microwave filters: band-pass, band-stop, quarter wave transformers, wideband and narrowband using transmission lines. Impedence matching and transformation. Planar transmission lines and components. Theory and application of microwave mixers: single-diode, balanced and double balanced microwave system considerations.

Prerequisite: Grad. Standing

FROM

ENSC 883-3 Optimal Control Theory

Comprehensive treatment of the optimal control theory, variational calculus and continual optimal control, the maximum principle and Hamilton-Jacob theory, optimal control system examples such as minimum time, regulators, minimum fuel, and minimum energy problems.

Prerequisite: ENSC 423 and ENSC 801

TO

ENSC 883-3 Optimal Control Theory

Review of finite dimensional linear systems represented in state space formulation. Bellman's Principle of Optimality and dynamic programming with applications to control of discrete and continuous time systems. Introduction to variational calculus, Pontryagin's Maximum Principle, Hamilton-Jacoby-Bellman Equation, and variational treatment of control problems. Several optimal control problems such as optimal Linear Quadratic Regulator (LQR), optimal tracking and suboptimal output controllers will be discussed.

Prerequisite: ENSC 423 and ENSC 801

FROM

ENSC 887-3 Vision for Robotics

Advanced machine vision techniques as applicable in robotics.

Prerequisite: none

TO

ENSC 887-3 Vision for Robotics

A brief review of mathematical techniques and fundamental paradigms in machine vision - edge detection, shape from shading, stereopsis and motion, and their relevance in robotics. Specific applications in robotics, e.g., parts inspection, structured light techniques for obtaining 3-dimensional structure, camera calibration. Surface Reconstruction and Interpolation. Surface/Volumetric descriptions for modelling 3-dimensional objects.

Prerequisite: none

FROM

ENSC 888-3 Finite-Element Methods in Engineering

Finite-element methods are examined from the viewpoint of the user (rather than the mathematician); the objective of the course is that the student should be able to use FEM with an intelligent grasp of its limitations.

Prerequisite: none

TO

ENSC 888-3 Finite-Element Methods in Engineering

Overview of FEM and its use in industry; mathematical foundations of FEM; Galerkin method; finite-element interpretation of physical problems in one, two and three dimensions; numerical techniques for storing and solving sparse matrices; checking for convergence, error estimation; pre- and post-processing; automatic mesh generation.

Prerequisite: none

FROM

ENSC 889-3 3D Object Representation and Solid Modelling

Description of current approaches, limitations. Applications in manufacturing and engineering.

Prerequisite: ENSC 439 and CMPT 351.

TO

ENSC 889-3 3D Object Representation and Solid Modelling

Introduction to concepts of 3D geometric modelling. Curve and surface descriptions including Bezier, B-Spline and NURBS. Polygonal representations. Regularized boolean set operations, primitive instances, sweep representations boundary representations, spatial partitioning and constructive solid geometry. Discussion of geometric coverage versus modeller complexity. User interface issues for solid modellers. Description of existing solid modellers and discussion of applications and limitations of solid modelling.

Prerequisite: ENSC 439-CMPT 351

S.92-4c

School of Resource and Environmental Management

Summary of Graduate Curriculum Revisions

SGSC Reference: Mtg. of November 25, 1991

SCAP Reference: SCAP 91-47

1. Change to Master's Degree Requirements
2. New course MRM 610-5, Management of Contaminants and the Environment.

Proposed Change to Master's Degree Requirements of the School of Resource and Environmental Management

July 11, 1991

Master's Degree Requirements Currently Read

Seventy-three (73) credit hours are prescribed for the program, 48 of which are from the required group and 25 are from the electives. With the approval of the program director, up to seven courses (35 credit hours) may be transfer credits from another institution.

Proposed Version (change is underlined)

Seventy-three (73) credit hours are prescribed for the program, of which 48 are from the required group and 25 from the electives. With the approval of the program director, up to seven courses (35 credit hours) may be transfer credits from another institution. In exceptional cases, a student presenting evidence of advanced education equivalent to one of the program courses from the required group may be allowed to waive that course by the program director, thereby reducing the total degree requirements to 68.

Rationale for the proposed change

The School of Resource and Environmental Management is an unusual program because of its provision of graduate level interdisciplinary training. As a consequence, its master's degree requires an exceptionally heavy course load. Most students benefit from taking all the required courses because even if a given course is in their area of expertise (economics, geomorphology, law, planning, ecology), there are usually additional issues to explore.

However, there are exceptional cases in which a student has such a high level of academic and applied expertise in a field covered by a certain required course that their participation in that course has negligible benefit. Since the course load of the school is already heavy, faculty feel that it is counterproductive to ask such students to take another course simply to meet the full credit requirement; the heavy course requirements are there solely to ensure the interdisciplinary training of students. It is for this reason that we propose to only allow the waiver possibility for courses from the required group of courses in the program.

Note that even with this waiver, master's students in the School of Resource and Environmental Management would still face course requirements that greatly exceed the university's minimum requirements for a project-based master's degree.

New Graduate Course Proposal Form

CALENDAR INFORMATION:

Department: School of Resource and Environmental Management **Course Number:** MRM 610-5

Title: Management of Contaminants in the Environment

Description: Application of Scientific Methodology and Concepts Regarding Pollutant Behaviour and Effects in Environmental Management.

Credit Hours: 5 **Vector:** 3-0-2 **Prerequisite(s) if any:** none

ENROLLMENT AND SCHEDULING:

Estimated Enrollment: 10-15 **When will the course first be offered:** 91/92

How often will the course be offered: once per academic year

JUSTIFICATION:

see attached

RESOURCES:

Which Faculty member will normally teach the course: Dr. Frank Gobas

What are the budgetary implications of mounting the course: none

Are there sufficient Library resources (append details): yes

Appended:
a) Outline of the Course
b) An indication of the competence of the Faculty member to give the course.
c) Library resources

Approved:
Departmental Graduate Studies Committee: [signature] Date: July 5/91
Faculty Graduate Studies Committee: [signature] Date: Sept 9/91
Faculty: [signature] Date: Sept 9/91
Senate Graduate Studies Committee: [signature] Date: Nov 27/91
Date:

2.

COURSE PROPOSAL

Frank Gobas
School of Resource & Environmental Management

COURSE TITLE : MANAGEMENT OF CONTAMINANTS IN THE ENVIRONMENT (MRM 610-5)

COURSE OBJECTIVES & OUTLINE :

I. **to provide students with knowledge of**

(a) scientific processes controlling the distribution and impacts of chemical substances, pollutants and waste (biotic and abiotic) in environmental systems

This includes a discussion of

(i) the environmental pathways of contaminants:

This includes environmental partitioning, dynamics of environmental distribution, mass-balances, mechanisms of transport, global transport & cycles (e.g. carbon cycle), long range atmospheric transport, cold-finger effect.

(ii) chemical-biota interactions:

At the single species level: uptake and elimination mechanisms, exposure dynamics, toxicokinetics and bioaccumulation (in phytoplankton, benthos, fish, birds, human)

At a multi species/community level: trophodynamics and food-chain dynamics of chemicals & pollutants.

(iii) impacts of chemical substances and pollutants on natural resources such as fish, forests and wildlife:

Biophysical impacts: Ozone depletion, pH changes, temperature

Toxicological impacts (single species level): toxicology (dose-effect relationship, toxicity of single and mixtures of substances).

Biological impacts (multi species level): ecotoxicology, community impacts.

Examples include effect of acid emissions on forests and the ecology of lakes, the effects of PAHs, dioxins and other contaminants on tumor incidence in fish, and the impacts of metals and radioactive substances on wildlife populations.

(b) the methodologies and techniques to measure, monitor, assess and predict the environmental behaviour and impacts of chemical substances and pollutants

As part of methodologies and techniques we will discuss

(i) Methods and techniques used for quantitative and qualitative measurements, including

a) Chemical analysis (This section focuses on what techniques are available for quantitative and qualitative measurement of environmental contaminants)

b) Toxicological impact assessment (Acute lethality tests, Enzyme Bioassays (e.g. MFO), Ames test, others)

c) Ecotoxicological impact assessment (e.g. species and community composition, enumeration studies etc.)

(ii) Risk assessment methodologies

(iii) Monitoring techniques and methodologies, including physical-chemical monitoring, biomonitoring, early-warning systems

(iv) Methods for predicting and management of substances and pollutants in the environment, including environmental modelling, expert systems, response systems.

II. The application of scientific concepts, methodologies and techniques in environmental management.

The second objective of the course is to investigate the practical application of scientific research, methodologies and techniques in environmental management.

In a series of case studies, the students examine the scientific basis of environmental management practices, including the development of standards and environmental (air, water) quality criteria/guidelines, screening, risk assessment, hazard assessment, testing protocols, monitoring and others.

This course provides students with the ability to apply and integrate various scientific principles and techniques regarding the biophysical behaviour of contaminants. This will enable them to develop effective management strategies and impact assessments based on sound and best available scientific knowledge.

Justification of course MRM-610

Future environmental and resource managers must be exposed to and become familiar with multidisciplinary aspects of environmental & resource management issues. This is the objective of MRM-610, which discusses various topics related to biophysical impact assessment and management of contaminants.

Some of the topics that will be discussed in MRM-610 are discussed in considerably more detail in other courses. For example, water chemistry is discussed in detail in CHEM 371-3 and some topics in toxicology are covered in Industrial Toxicology (BISC 650), Problem Analysis in Environmental Toxicology (BISC 652) and Environmental Toxicology II (BISC 313). The nature of these courses is quite different from that of MRM-610, reflecting the focus and objectives of the respective departments. The focus of MRM-610 is not to provide detailed insights into toxicology, chemistry or biology, but to integrate various disciplines to develop management strategies. The course is not meant to train chemists or toxicologist, but to provide students with tools to apply chemical, biological and other principles. In addition, most students taking this course are students from the School of Resource & Environmental Management. Many of these students do not have any former training in chemistry, toxicology, biology or engineering. This means that the detail in this course will be considerably different from that of other courses in for example Chemistry or Biological Sciences.

MRM-610 can thus be justified on the grounds that:

1) The majority of the topics discussed in MRM-610 are not being offered in any other SFU courses.

2) No other single course at SFU provides the combination of environmental topics that environmental managers require as basic background knowledge.

3) The focus of the course is to integrate and apply principles from different research areas. This requires that various topics be discussed in one course.

4) The background of the anticipated students requires that chemical, biological, toxicological, engineering and other principles and techniques be discussed in a special format, that provide opportunities to all students (science and non-science students) to master all aspects of environmental management discussed in this course.

Regarding the competence of Dr. F. Gobas to teach Course MRM 610-5:

Dr. F. Gobas has published 21 refereed journal papers in various scientific journals, 6 refereed book chapters, 4 technical reports and 5 non-refereed publications on a variety of topics related to the dynamics and impacts of toxic substances in the environment. These topics include the physical chemical behaviour of toxic organics, chemical-biota interactions (in fish, benthic invertebrates, plants and humans), toxicokinetic and toxicological aspects of chemical behaviour in the environment, environmental modelling and risk assessment.

Dr. Gobas is also the principal editor of a book "entitled "Chemical Dynamics in Fresh Water Ecosystems", to be published this winter by Lewis Publishers.

He received approximately $690,000 in research funding (i.e. funding directly allocated to him), over a 3 year period (i.e. from 1988 to 1991), amounting to $230,000 per year. Research funding was obtained from the Ontario Ministry of the Environment, the International Joint Commission and the BC Ministry of the Environment to develop tools for environmental management of toxic substances in the Great Lakes and the Fraser River.

Dr. Gobas is Canada's expert on bioaccumulation for Environment Canada. He has been a member of the Lake Ontario Toxics Committee Review Panel, a binational committee set up to review whole lake management models for toxic substances in the Great Lakes. Dr. Gobas was the work group coordinator of "Biotic Models" section of the Great Lakes Mass Balance work group of the International Joint Commission. Dr. Gobas has been consultant to the Health Advisory Committee of the International Joint Commission regarding chemical contaminants in human breast milk.

Dr. Gobas' research has won awards from the Society of Environmental Toxicology and Chemistry and the J.R. Brown Foundation for research in environmental and occupational health. A CV and publication list are attached for more specific information about Dr. Gobas' credentials in the area of environmental research and management.

SIMON FRASER UNIVERSITY

MEMORANDUM

To: Marion McGinn

From: Sharon Thomas
Collections Management

Subject: NEW COURSE PROPOSAL

Date: November 28, 1991

I have examined the reading list and course proposal for

MRM 610-5 MANAGEMENT OF CONTAMINANTS IN THE ENVIRONMENT.

and it appears that we are reasonably able to support the stated requirements of the course.

Sharon Thomas

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