

SIMON FRASER UNIVERSITY

S.81-100

MEMORANDUM

To: SENATE

From: SENATE COMMITTEE ON ACADEMIC PLANNING/
SENATE COMMITTEE ON UNDERGRADUATE STUDIES

Subject: ENGINEERING PROPOSAL

Date: JUNE 30, 1981

Action taken by the Senate Committee on Academic Planning at its meeting on June 24, 1981, and by the Senate Committee on Undergraduate Studies at its meeting of June 30, 1981, gave rise to the following motion:

"That Senate approve and recommend approval to the Board of Governors, as set forth in S.81-100, the Engineering Proposal - Phase I - Extension of Transfer Program, including new course proposals for:

- ENGG 101-0 - Engineering Orientation I
- ENGG 102-0 - Engineering Orientation II
- ENGG 100-6 - Engineering Communications
- ENGG 110-3 - Engineering Graphics
- ENGG 210-3 - Computer Aided Design
- ENGG 215-3 - Engineering Materials
- ENGG 218-2 - Engineering Laboratory A
- ENGG 219-2 - Engineering Laboratory B
- ENGG 220-3 - Introduction to Chemical Engineering I
- ENGG 221-3 - Introduction to Chemical Engineering II
- ENGG 230-3 - Municipal Water Supply and Waste Disposal
- ENGG 235-3 - Surveying
- ENGG 240-3 - Basic Electrical Engineering
- ENGG 242-3 - Analog and Digital Electronics
- ENGG 244-3 - Micro-processor Systems
- ENGG 246-3 - Engineering Electromagnetics."

Note: This proposal replaces S.81-16 - Proposal for a Faculty of Engineering at Simon Fraser University - which failed to gain support from the Universities Council.

SIMON FRASER UNIVERSITY

MEMORANDUM

To..... SENATE COMMITTEE ON UNDERGRADUATE
STUDIES

From..... THOMAS W. CALVERT

DIRECTOR OF ENGINEERING

Subject..... PHASE I OF ENGINEERING PROPOSAL

Date..... JUNE 29, 1981

We have now had an opportunity to discuss the proposed Second Year of the Engineering Transfer Program in some detail with Dr. N. Risebrough, who is Assistant Dean of Applied Science and Director of the Engineering Core Program at UBC. As a result of this discussion I am requesting some minor changes in the program recommended for transfer students. The changes, which do not affect any of the proposed new courses, are:

1. In Semesters 1 and 2, GEOG 112-3 - Introductory Geology, can be replaced with other courses with the permission of the Director of Engineering.
2. In Semesters 5 and 6 of Civil Engineering, the new course ENGG 235-3 - Surveying, will have to be supplemented by a Field School. It is expected that it will be possible for SFU students to join the UBC Field School which is run at the end of their Second Year.

It should be noted that the courses designated MECH are administered by the Department of Mathematics. The Department has agreed in principle to develop the new course MECH 363-3 - Engineering Dynamics, and to change the designation of MATH 262-4, 263-4, 265-4 and 362-3 from MATH to MECH. The formal request for this will reach SCUS in due course.

SIMON FRASER UNIVERSITY

MEMORANDUM

SCUS 81-30A

To.....Dr...J...Chase.....	From.....Thomas W...Calvert.....
.....Secretary,..SCAP.....Director of Engineering.....
Subject..ENGINEERING..PROPOSAL.....	Date.....June 16...1981.....

I enclose a copy of THE PROPOSAL FOR THE DEVELOPMENT OF ENGINEERING AT SIMON FRASER UNIVERSITY: PHASE I - EXTENSION OF THE TRANSFER PROGRAM. Please place this on the Agenda of the SCAP meeting scheduled for June 24.

This Proposal was approved by the Engineering Committee at a meeting on Friday, June 12. The Committee has the following composition:

- T.W. Calvert (Chairman)
- D.A. George (Chairman after July 1)
- J. D'Auria
- R. Frindt
- L. Boland
- E. Shoemaker/G.A.C. Graham

The proposal is currently being discussed with the Faculty of Applied Science at UBC and they have indicated their approval in principle; indeed, they have offered us every assistance in implementing the proposal.

It should be noted that while we are asking for approval of a number of new courses which are to be developed specifically for Engineering we are not requesting the approval of any credential at this time. We expect to advise students that the successful completion of this program will allow them to transfer into the third year of Engineering at UBC. The course sequence will also be appropriate for entry into third and fourth year Engineering programs which will be proposed for development at SFU. As noted in the proposal, we fully expect to modify the program and to make more options available both at the time SFU's degree programs go into operation and when UBC moves from a five year to a four year degree program in 1983.

We are requesting accelerated approval for this Proposal in order that it can be approved by the Board of Governors in time to be submitted to Universities Council in August 1981. Council will be asked to approve the Proposal and recommend funding by October 1981 so that we can initiate the recruitment of faculty to take up appointments for September 1982.

ENCLOSURE

TWC/pgm

- c.c. J.M. Munro
- K.G. Pedersen
- H. Nagel, Acting Registrar

T.W. Calvert

PROPOSAL FOR THE DEVELOPMENT OF ENGINEERING

AT SIMON FRASER UNIVERSITY

PREAMBLE

The Universities Council of B.C. has invited Simon Fraser University to consider the development of an Engineering Program concentrating on high technology and engineering science and utilizing the strengths of existing departments such as Mathematics, Computing Science, Physics and Kinesiology. This is an interesting and potentially fruitful development for the University but the limitations of this approach should be clearly understood.

First, it must be recognized that Engineering Science, as it is understood in Canada, is typically a relatively small, high quality program which is part of a full School of Engineering. The core courses taken by all engineers are combined with courses from selected scientific disciplines to give options in such fields as Engineering Physics, Computer Engineering, Engineering Mechanics, etc. Thus if a program concentrating on high technology and engineering science is to be developed in a University without a Faculty of Engineering, and if the program is to have any legitimacy as Engineering, then a substantial core of engineering courses will have to be developed.

Other problems relate to the first. Acceptance of a program by industry and the profession will depend on its quality and on whether it is perceived as legitimate engineering. This comes into focus when the program is considered for accreditation; without accreditation, graduates of the program will have difficulty becoming registered as professional engineers. Accreditation and registration are of less importance in high technology industries but to date there are no Canadian universities offering engineering which do not have accredited programs. A related problem is the recruitment of good students. Engineering Science is a challenging program and because of this many students may hesitate to come to a university where the more conventional options in electrical, civil and mechanical engineering are not available.

We believe that the problems noted above can be overcome if (a) the program is of high quality, (b) areas of specialization are chosen to be technically exciting, (c) sufficient resources are provided to mount a substantial core program in engineering and (d) some assistance is provided by the University of B.C. These points suggest that the new program should involve two phases of development. In Phase 1 the transfer program will be extended to two years of engineering and in Phase 2 a number of relatively small four year degree programs in priority areas of high technology will be developed.

At this time the Phase I Proposal for the Extension of the Engineering Transfer Program to two years is proposed, with implementation to take place in September 1982. The Phase II Proposal for third and fourth year programs will be presented to Senate in December 1981.

PHASE I: EXTENSION OF THE TRANSFER PROGRAM

Currently Simon Fraser University offers a program which allows a student to complete two of the five years of the University of British Columbia program, however, this is only one year of Engineering. This extension involves the development of a number of core engineering courses (which are just those needed for Engineering Science) plus the development of a small number of more specialized courses. In order to handle students transferring into Civil, Electrical, Mechanical and Chemical engineering at the University of British Columbia the total number of new lecture courses required is fourteen plus two laboratory/project courses. In this context it should be noted that Dean Wedepohl of the University of British Columbia offered us every co-operation in doing this and has suggested that they might be able to assist us with certain courses either by providing instructors or by transmitting University of British Columbia courses over the KNOW network. It is expected that each year of the

Transfer Program might initially enrol about 40 students and that this might grow to 140-160 students. The growth of the Transfer Program will be carefully co-ordinated with the University of British Columbia to ensure that the numbers can be accommodated. It is expected that after several years 80 students per year may transfer to the third year at the University of British Columbia and 50-60 may continue at Simon Fraser University.

CURRICULUM

The proposed second year curriculum is designed to meet the following goals:

1. To allow students to transfer into the third year of Engineering at the University of British Columbia in the following areas
 - Chemical Engineering
 - Civil Engineering
 - Electrical Engineering
 - Mechanical Engineering

(No specific provision will be made for other Engineering programs but it is noted that students intending to elect Bio-Resource Engineering, Metallurgical Engineering and Mineral Engineering would only need a one or two additional second year courses.)

2. To provide for minimal change when the University of British Columbia moves from a 5-year to a 4-year program in 1983.
3. To provide the majority of courses needed as prerequisites for the proposed third and fourth year high technology/engineering science degrees at Simon Fraser University.
4. To make use, where needed, of courses transmitted from the University of British Columbia over KNOW.

It is expected that the initial curriculum proposed here will be supplemented and ammended as the third and fourth year Simon Fraser University programs are developed and when the University of British Columbia moves to a four year Engineering Program. As noted, the development will be carefully co-ordinated with the University of British Columbia to ensure that transfer students can be accommodated.

PROPOSED ENGINEERING TRANSFER PROGRAM

Admission requirements for the University can be found in the current Calendar. Students intending to elect the Transfer Program set out below require the following prerequisites from British Columbia High Schools: Algebra 12, Chemistry 12, Physics 12.

2. To provide for minimal change when the University of British Columbia moves from a 5-year to a 4-year program in 1983.
3. To provide the majority of courses needed as prerequisites for the proposed third and fourth year high technology/engineering science degrees at Simon Fraser University.
4. To make use, where needed, of courses transmitted from the University of British Columbia over KNOW.

It is expected that the initial curriculum proposed here will be supplemented and ammended as the third and fourth year Simon Fraser University programs are developed and when the University of British Columbia moves to a four year Engineering Program. As noted, the development will be carefully co-ordinated with the University of British Columbia to ensure that transfer students can be accommodated.

PROPOSED ENGINEERING TRANSFER PROGRAM

Requirements for admission to the University are given in the current Calendar. Students intending to take the Engineering Transfer Program set out below should have completed B. C. High School Grade 12 in Algebra, Chemistry and Physics, or equivalent, for entry to first year science courses.

The six semester program will allow transfer either to year three of UBC Engineering or continuation into the proposed third year of SFU Engineering. The proposed programs for semesters 1-4 are very similar to those already being offered. (*indicates new courses and ** indicates new courses included in the original proposal for a Faculty of Engineering). All new Engineering courses are designated ENGG; the numbers X20-X21 indicate Chemical Engineering, X30-X39 indicate Civil Engineering, X40-X49 indicate Electrical Engineering and X50-X59 indicate Mechanical Engineering. Existing and new Mechanics courses are designated MECH.

Semesters 1 and 2

MATH 151-3	Calculus I
MATH 152-3	Calculus II
CHEM 104-3	General Chemistry I
CHEM 105-3	General Chemistry II
CHEM 115-2	General Chemistry Laboratory I
PHYS 120-3	Physics I
PHYS 121-3	Physics II
PHYS 131-2	General Physics Laboratory
**ENGG 100-6	Engineering Communications (Note: initially this requirement may be satisfied by selecting two of ENGL 101-3, 102-3, 103-3).
CMPT 103-4	Introduction to a High Level Programming Language I
GEOG 112-3	Introductory Geology (Note 4)
T O T A L	C R E D I T S = 35

Semesters 3 and 4 (Year 1 of Engineering)

MATH 251-3 Calculus III
MATH 252-3 Vector Calculus I
MATH 232-3 Elementary Linear Algebra
MATH 310-3 Introduction to Ordinary Differential
 Equations
CHEM 261-3 Physical Chemistry I
PHYS 221-3 Intermediate Electricity and Magnetism
PHYS 233-2 Introductory Physics Laboratory A
MECH 262-4 Engineering Mechanics I (Statics) (Note 1)
MECH 263-4 Engineering Mechanics II (Dynamics) (Note 1)
*ENGG 110-3 Engineering Graphics
*ENGG 101-0 Engineering Orientation I
*ENGG 102-0 Engineering Orientation II
CMPT 105-3 Fundamental Concepts of Computing
Humanities and Social Science Electives: 6

T O T A L C R E D I T S = 40

Semesters 5 and 6 (Year 2 of Engineering)

Common to all programs: (22 credits)

- MATH 314-3 Boundary Value Problems
- MATH 316-3 Numerical Analysis I
- MATH 272-3 Introduction to Probability and Statistics
- *ENGG 240-3 Basic Electrical Engineering
- *ENGG 218-2 Engineering Laboratory A
- *ENGG 219-2 Engineering Laboratory B

Humanities and Social Science Electives: 6

Civil Engineering: (19 credits)

- MECH 265-4 Engineering Mechanics III (Strength of Materials) (Note 1)
- MECH 362-3 Fluid Mechanics I (Note 1)
- MECH 363-3 Engineering Dynamics (Note 2)
- **ENGG 215-3 Engineering Materials
- *ENGG 230-3 Municipal Water Supply and Waste Disposal
- **ENGG 235-3 Surveying (Note 5)

T O T A L C R E D I T S = 41

Mechanical Engineering: (16 credits)

- **MECH 265-4 Engineering Mechanics III (Strength of Materials) (Note 1)
- **MECH 362-3 Fluid Mechanics I (Note 1)
- *MECH 363-3 Engineering Dynamics (Note 2)
- *ENGG 210-3 Computer Aided Design
- **ENGG 215-3 Engineering Materials

T O T A L C R E D I T S = 38

Electrical Engineering: (18 credits)

MATH 322-3 Complex Variables
*ENGG 210-3 Computer Aided Design
**ENGG 242-3 Analog and Digital Electronics
**ENGG 244-3 Micro-processor Systems
*ENGG 246 -3 Engineering Electromagnetics
MATH 401-3 Switching Theory and Logic Design (Note 3)
T O T A L C R E D I T S = 40

Chemical Engineering: (17 credits)

**ENGG 215-3 Engineering Materials
CHEM 251-3 Organic Chemistry I
CHEM 252-3 Organic Chemistry II
CHEM 256-2 Organic Chemistry Laboratory
*ENGG 220-3 Introduction to Chemical Engineering I
*ENGG 221-3 Introduction to Chemical Engineering II
T O T A L C R E D I T S = 39

Notes

1. The existing Mechanics courses shown as MECH 262-4, 263-4, 265-4 and 362-3 are currently offered by the Department of Mathematics as MATH 262-4, 263-4, 265-4 and 362-3. It is recommended that these courses continue to be offered and administered by the Department of Mathematics but that the designation be changed to MECHANICS (MECH).
2. It is proposed that this new course be developed and administered by the Department of Mathematics.
3. A proposal is pending to joint list MATH 401 between Computing Science and Mathematics as MACM 401. The departments will be asked to examine whether this could become a 300 level course.
4. Other appropriate courses may be substituted with the approval of the Director of Engineering.
5. Students also will be required to participate in a Surveying Field School. It is expected that this can be arranged at UBC.

NEW COURSES

NOTE: Those indicated ** were developed and approved for the original Engineering Proposal. (S-81-16), but changes have been made as shown to course numbers and designations.

**ENGG 100-6 Engineering Communications

Rationale

The objective of this course is to develop the student's written, verbal and graphical communication skills to an acceptable level. The basic premise is that these skills are best learned and demonstrated in the context of the student's work in engineering. Evaluations of laboratory reports, course essays, and project reports will, as a result, be central to this course. Demonstrated competence is required and unsatisfactory work is returned to the student to be done again. Communication skills must be demonstrated at a satisfactory level before the student will receive course credit.

Calendar Description

This course is spread throughout the duration of the engineering program. It is concerned with written, verbal and graphical communications. Course credit is obtained by demonstration of a proficiency in the skills of engineering communication.

For the most part the need for communications will arise in various courses in the program such as in laboratory reports, course essays and project reports. Other activities will be specified for the particular engineering program in which the student is enrolled. The final report and interim oral report to the Engineering Project undertaken during the final semester of the program will be components of ENGG 100. This course will also include essays based on the guest lecturer series. Visual literacy, utilization

of information resources such as libraries and computer graphics are within the scope of this course.

Particular requirements will be specified as the student progresses with his studies. A resource centre, tutorials, self-instructional materials, audio-visual materials, lectures, mini-courses and other instructional methods are utilized to aid the student in acquiring these skills which are considered important in the practice of the engineering profession. The student will formally register for the course in the semester in which all requirements are completed. Normally this will be the sixth semester. The course is graded on a credit/no entry basis.

ENGG 101-0 Engineering Orientation I

ENGG 102-0 Engineering Orientation II

A series of bi-weekly seminars in which practicing engineers discuss engineering problems. A number of off-campus visits will be arranged.

ENGG 110-3 Engineering Graphics 2-0-4

Orthographic projection, graphic solution of space and vector problems, engineering sketching. An introduction to computer graphics and computer assisted drafting. Prerequisite: MATH 151-3, CMPT 103-4

ENGG 210-3 Computer Aided Design 3-1-0

The design process as applied to mechanisms and electrical circuits. Manual solution of a variety of problems. Development of computer techniques to assist design. Experience with at least one CAD system. Prerequisites: ENGG 240-3, MECH 263-4, CMPT 105-3

**ENGG 215-3 Engineering Materials 3-0-0 (Formerly MECE 230-3)

Introduction to the science of materials relating their mechanical, thermal, electronic and chemical properties to atomic, molecular and crystal structure. Ceramics and metals, glasses, polymers and composite materials. Multi-phase materials, strengthening processes. Mechanical properties of metals and polymers, micro-structure, heat treatment of steel, corrosion. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Prerequisite: CHEM 261-3

ENGG 220-3 Introduction to Chemical Engineering I 2-2-0

Material balances; phase equilibria; chemical process technology. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Prerequisite: CHEM 261-3

ENGG 221-3 Introduction to Chemical Engineering II 2-2-0

Continuation of ENGG 220. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Prerequisite: ENGG 220-3

ENGG 230-3 Municipal Water Supply and Waste Disposal 2-2-0

The engineering aspects of providing a community with adequate water supply, collecting storm water, collecting and disposing of sewage, and managing its solid wastes. Emphasis will be placed on practical aspects of problems facing Western Canada.

Pre-requisite: MECH 263-4

**ENGG 235-3 Surveying 1-0-3 (Formerly CIVE 271-2. n.b. change of credit)

Plane surveying; route surveying, practical astronomy, statistical treatment of data, horizontal and vertical curves. Field methods, secondary triangulation; base line measurements; cross sectioning and earthwork; highway/ railway layouts, electronic distance measurements.

Lectures and field work. A field practice survey camp will be arranged at the end of the semester.

Prerequisite: MATH 152-3

**ENGG 240-3 Basic Electrical Engineering 3-0-0 (see below)

Nature and properties of electrical circuits; basic circuit elements; voltage and current sources; Kirchoff's laws; linearity and superposition; Thevenin and Norton Theorems. AC signals and phasors. AC steady state circuit analysis; impedance, admittance and transfer properties; frequency response; detailed treatment of first order (RL and RC) circuits; properties of LC circuits. Basic characteristics of electrical generators, motors, transformers and transmission lines. Electrical power distribution; power factor. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Pre-requisites: PHYS 121-3, 131 3, Corequisite: MATH 251-3

The above course was formerly approved as ELEC 250-3.

**ENGG 242-3 Analog and Digital Electronics 3-0-0

A course which treats the introductory aspects of electronics. Topics covered are: basic properties of semi-conductor diodes and transistors; biasing circuits; linear amplifiers; logic gates; bistable circuits; multi-stage circuits and loading. Applications of digital circuits in computing and control. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Prerequisites: PHYS 121-3, MATH 152-3

The above course was formerly approved as ELEC 221-3

ENGG 246-3 Engineering Electromagnetics 3-2-0

Review of vector analysis; electrostatic and magneto-static fields in free space and material bodies, voltage-current relations of circuit elements, electro mechanics and electro mechanical devices. Time varying fields. A portion of the ENGG 18 and 19 Laboratories will be associated with this course.

Prerequisite: PHYS 221-3

**ENGG 244-3 Microprocessor Systems 1-3-0 (Formerly ELEC 260-3)

A workshop course taken in association with appropriate laboratory work which aims to apply the student's basic background in electronics and computing to the design of mini and micro-processors for process and system control. Lectures stress topics in real-time computing: input/output via program control, priority and vectored interrupts, direct memory access, peripherals; system architecture. A portion of the ENGG 218 and 219 Laboratories will be associated with this course.

Prerequisites: CMPT 103-4, 105-3, Computing Experience, ENGG 242-3

MECH 363-3 Engineering Dynamics 2-2-0 (Under development)

Graphical and analytical methods for kinetics of particles. Plane kinematics of rigid bodies; rotating frame. Space kinematics of rigid bodies. Euler's equations. Free and forced vibrations of a system with a single degree of freedom. Applications.

Prerequisites: MECH 263-4; MATH 310-3 must precede or be taken concurrently.

LABORATORY COURSES

*ENGG 218-2 Engineering Laboratory A (0 - 0 - 4)

*ENGG 219-2 Engineering Laboratory B (0 - 0 - 4)

These laboratory courses provide students with a portfolio of experiments, problems and projects related to the lecture courses in the respective semesters. In addition, each student will identify a design/research project to be carried out over the two semester period and completed by the end of the second semester.

ORGANIZATION AND STRUCTURE

It is anticipated that a proposal for a Faculty (or School) of Engineering will have been approved before the courses proposed here are implemented in September 1982. Until such a structure is approved, the development and operation of the courses will be supervised by the Engineering Committee which will function as Steering Committee for the Program. The Committee is chaired by the Director of Engineering. At this time all new courses, not offered by existing departments, will be designated Engineering (ENGG). This does not preclude the designation of these later into engineering specializations.

SUMMARY OF RESOURCE NEEDS FOR NEW COURSES

It is assumed that enrollment in years one and two of the Transfer Program will be approximately equal, i.e. attrition is balanced by transfer into the Program. The build up of enrollment and the split between specializations is estimated below:

ENROLLMENT IN YEAR 2

Program	Year of Program Development			
	1982	1983	1984	1985
Chemical	0	10	15	15
Civil	13	22	32	37
Electrical	14	25	40	60
Mechanical	13	23	33	38
TOTAL	40	80	120	150

It is predicted that the number of students transferring to the third year of Engineering at the University of British Columbia will rise to 80 and that the third year enrollment at Simon Fraser University will rise to 50 or 60.

Number of Additional Courses: 14 lecture
2 laboratories

Faculty and Staff Requirements:

Dean or Director	1
Faculty	5
Sessional Instructors	2
TA Basic Units	
Laboratory Instructor	1
Technician	1
Administrative Assistant	1
Secretarial/Clerical	1.5

BUDGET SUMMARY (\$1000,s)

<u>Recurring</u>	<u>1982/83</u>	<u>1983/84</u>
Academic Salaries	268.4	362.5
Support Staff Salaries	81.0	90.0
Total Salaries	349.4	452.5
Total Non Salary	54.5	94.5
TOTAL-DIRECT OPERATING	403.9	547.0
50% Overhead	201.95	273.5
TOTAL REQUEST FOR RECURRING FUNDS	605.85	820.5
TOTAL REQUEST FOR NON RECURRING FUNDS	172.0	71.0
TOTAL REQUEST	777.850	891.500