S.89-42

SIMON FRASER UNIVERSITY

MEMORANDUM

To: Senate

From: L. Salter
Chair, SCAP

Subject: School of Engineering Science - Curriculum Revision
Reference: SCUS 89-36
SCAP 89-27

Date: November 9, 1989

Action undertaken by the Senate Committee on Academic Planning/Senate Committee on Undergraduate Studies gives rise to the following motion:

Motion:

"That Senate approve and recommend approval to the Board of Governors as set forth in S.89-42 the proposed

New course ENSC 453 - 4 Semiconductor Device Engineering."

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: Engineering Science

Abbreviation Code: ENSC Course Number: 453 Credit Hours: 4 Vector: 3-0-2

Title of Course: Semiconductor Device Engineering

Calendar Description of Course: Design of semiconductor devices, quantitative relationships among electrical, technological and material parameters, device modelling techniques, physical limitations for devices, engineering aspects of device integration and fabrication, interaction between devices in the integrated circuit. The laboratory focusses on measurement, characterization, and modelling of semiconductor devices.

Nature of Course Lectures/Labs

Prerequisites (or special instructions):
PHYS 365-3

What course (courses), if any, is being dropped from the calendar if this course is approved: NONE

2. Scheduling

How frequently will the course be offered? Every third semester

Semester in which the course will first be offered? Spring 1991

Which of your present faculty would be available to make the proposed offering possible? Jamal Deen, Marek Syrzycki

3. Objectives of the Course To teach the students the operation, design, measurement of semiconductor devices. With this background, the students will be able to design a variety of integrated circuits and sensors in MOS and bipolar technology. The modelling and characterization of devices will also be examined.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty None

Staff None

Library None

Audio Visual None

Space None

Equipment None

5. Approval

Date: 17/10/89 25/10/89 11/1/89

Department Chairman Dean Chairman, SCUS

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

Simon Fraser University

MEMORANDUM

To: Dr. Paul Ho, Chairman of Undergraduate Program Committee, School of Engineering Science	**From:** R.F.Frindt, M.Syrzycki, J.Deen Physics/Engineering
Subject: Semiconductor Device Engineering course	**Date:** 11 October, 1989

On 6th October, we met together to discuss details of the proposed Semiconductor Device Engineering course (ENSC 453-4). During this meeting, the possible versions of the ENSC 453 were discussed. The participants of this meeting agreed that the ENSC 453 should be based on two course sequence on Semiconductor Devices: Semiconductor Devices Physics (PHYS 365) followed by Semiconductor Device Engineering (ENSC 453). The above sequence was suggested by prof. D.George in his memo from 11 September. The ENSC 453 course requires PHYS 365 as a prerequisite and does not overlap the contents of PHYS 365. We enclose the outline of the ENSC 453 accepted by representatives from Engineering and Physics, as well as the outline of the PHYS 365 provided by Dr. R.F.Frindt.

Responding to our concerns about PHYS 385 as a prerequisite for PHYS 365, Dr. R.F.Frindt declared that this requirement can be cancelled for Engineering Science students.

We recognize from your memo (26 September) that the ENSC 453 proposal was approved by FASUCC conditional upon being free of any overlap. We did our best for removing this overlap and we suggest you to forward the approved ENSC 453 proposal to SCUS as soon as possible.

Yours truly,
R.F.Frindt, M.Syrzycki, J.Deen

c.c.
D.George, Dean of Applied Science
D.George, Director, Engineering Science

Oct 12/89.

RFFrindt

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ENSC 453-4: SEMICONDUCTOR DEVICE ENGINEERING

Textbook: "Basic Integrated Circuit Engineering"
Author: D.J.Hamilton, W.G.Howard
Publisher: McGraw-Hill

Course Description:
Design of semiconductor devices, quantitative relationships between electrical, technological and material parameters, device modeling techniques, physical limitations for devices, engineering aspects of device integration and fabrication, interaction between devices in the integrated circuit. The laboratory focussed at measurement, characterization, and modeling of semiconductor devices will be a part of the course.

Prerequisite: PHYS 365-3

Course Outline:

1. Design of passive semiconductor devices
   - linear and voltage-controlled resistors
   - capacitors (MOS c., junction c., linear c.)

2. Design of active semiconductor devices
   - semiconductor diodes semiconductor controlled rectifiers
   - bipolar junction transistors
   - MOSFET's
   - JFET's and MESFET's

3. Modeling and simulation of semiconductor devices
   - models of semiconductor devices in SPICE simulator
   - extraction of model parameters from device measurements
   - 2-D and 3-D models of semiconductor devices

4. Physical limitation of silicon devices
   - material limitations in semiconductor devices
   - small-geometry effects and hot-carrier degradation in MOSFET's
   - small geometry effects, high-level injection effects and parasitics in BJT's

5. Engineering aspects of device integration
   - technology-related limitations
   - practical techniques for device isolation in IC's

PHYSICS 365-3: SEMICONDUCTOR DEVICE PHYSICS

DAY
SPRING 1988
MWF 9:30
Dr. R. Frindt
Office P8470

Textbook "Solid State Electronic Devices"
(2nd Edition)
Author: Ben G. Streetman
Publisher: Prentice Hall

Course Description

Structure and properties of semiconductors, semiconductor theory, theory and operation of semiconductor devices, semiconductor device technology.

Prerequisite: PHYS 385-3

Course Outline

a) Introduction to Condensed Matter Physics:

-the crystal lattice - phonons, energy bands
-semiconductors - electrons, holes, density-of states, effective mass
-carrier concentration, doping, recombination
-the Fermi Energy, quasi-Fermi energies
-mobility, conductivity, Hall effect
-optical properties of semiconductors

b) Semiconductor Devices:

-diodes (junction, Schottky, LED's, laser diodes, photocells and photodiodes)
-JFET's and MOSFET's
-bipolar transistors

c) Device Technology:

-crystal growth - (Czochralski, float-zoning, epitaxy)
-compound semiconductors, alloys
-doping - diffusion, implantation, annealing
-contacts
-integrated circuit technology - lithography, etching