TO: The Faculty of the College of Engineering

FROM: School of Electrical and Computer Engineering of the College of Engineering

RE: ECE 65900 Changes in Title, Prerequisite, Description and Text

The faculty of the School of Electrical and Computer Engineering has approved the following changes in ECE 65900. This action is now submitted to the Engineering Faculty with a recommendation for approval.

From: **ECE 65900 – Quantum Phenomena in Semiconductors**
Prerequisite: EE 606 and MA 511 or equivalent

This course is designed for graduate students familiar with semiconductor fundamentals, with engineering electromagnetics and with linear algebra, but having no significant acquaintance with either quantum mechanics or statistical mechanics. The purpose of the course is to introduce the relevant concepts of quantum mechanics and non-equilibrium statistical mechanics as possible using device-related examples. Topics include: preliminary concepts, equilibrium, restoration of equilibrium, transport, effective mass equation, optical properties, advanced concepts.

To: **ECE 65900 – Quantum Transport**
Sem. 2. Class 3, cr. 3.
Prerequisite: Graduate Standing

This course is designed for graduate students familiar with differential equations and linear algebra, but having no significant acquaintance with etiher quantum mechanics or statistical mechanics. The purpose of the course is to introduce the relevant concepts of quantum mechanics and non-equilibrium statistical mechancs using devide-related examples. We use MATLAB-based numberical examples to provide concrete illustrations and the homeworks require students to set up their own computer program on a PC to reproduce the results.

Reason: ECE 65900 was originally developed in the late 1980's and taught by a number of Professors during the 1990's including Profs. Lundstrom and Gray using the text: S. Datta, Quantum Phenomena, Addison-Wesley (1989). Around 1999, it was felt there was the need to modify the course suitably to adapt ot the changes in the field and to incorporate MATLAB-based examples. Supriyo Datta started writing what he thought would be a second edition fo the book, but it turned out to be essetnially a new book which has just appeared: S. Datta, Quantum Transport: Atom to Transistor, Cambridge University Press (2005), ISBN 0-521-63145-9. Supriyo Datta is requesting that the new book be adopted as the text for the course. The approach used in the book is uique and there is no other comparable text at this time. He is also requesting that the title be modified from Quantum Phenomena in Semiconductors to Quantum Transport since the emphasis (like the earlier version of the course) is distinctly on transport or current flow, although the discussion has been broadened beyond semiconductors.

ECE 65900 – Quantum Transport

Required Text: S. Datta, *Quantum Transport: Atom to Transistor*, Cambridge University Press (2005), ISBN 0-521-63145-9.

Weeks	Principle Topics
1	An atomistic view of electrical resistance - Lectures 1-5
2	Schrodinger equation – Lectures 6-8
3	Self-consistent field and Coulomb Blockade – Lectures 9-12
4	Basis functions – Lectures 13-16
5	Bandstructure – Lectures 17-20
6	Subbands – Lectures 21-23
	MIDTERM
7	Quantum vs. electrostatic capacitance – Lectures 24-26
8	Level broadening – Lectures 27-30
9	Coherent transport – Lectures 31-34
10	Non-coherent transport – Lectures 35-39
11	Atom to transistor – Lectures 40-41
12	Spin – Lectures 42-43
	FINAL

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