Office of the Registrar
FORM 40 REV. 7/08

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

Print Form

EFD 37-05

DEPARTMENT School of Electrical and Computer Engineering (EFD 37-05) EFFECTIVE SESSION Fall 2010

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [ ] 1. New course with supporting documents
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [x] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes (department head signature only)
- [ ] 8. Change in instructional hours
- [x] 9. Change in course description
- [x] 10. Change in course requisites
- [ ] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

PROPOSED:	EXISTING:
Subject Abbreviation	Subject Abbreviation ECE
Course Number	Course Number 45300
Long Title Fundamentals of Nanoelectronics	
Short Title Fund of Nanoelectronics	

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED
Check All That Apply:
[ ] Summer [x] Fall [ ] Spring

CAMPUS(ES) INVOLVED
[ ] Calumet [ ] N. Central
[ ] Cont Ed [ ] Tech Statewide
[ ] Ft. Wayne [x] W. Lafayette
[ ] Indianapolis

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs ____ (Check One) To [ ] Or [ ]
Maximum Cr. Hrs. ____
3. Equivalent Credit: Yes [ ] No [ ]

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ]
Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Special Fees [ ]
6. Registration Approval Type
Department [x] Instructor [ ]
7. Variable Title [ ]
8. Honors [ ]
9. Full Time Privilege [ ]
10. Off Campus Experience [ ]

ScheduleType	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	3	16	100
ecitation				
esentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses
____
____
____
____
____
____

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

Description: The development of nanotechnology has made it possible to engineer materials and devices on a length scale as small as several nanometers. The properties of such nanostructures cannot be described in terms of macroscopic parameters like mobility or diffusion coefficient and a microscopic, or atomistic, viewpoint is called for. The purpose of this course is to convey the conceptual framework that underlies this microscopic viewpoint using examples related to the emerging field of nanoelectronics.
Requisites: ECE 30500 (may be taken concurrently) and MA 26600 and MA 26500 or MA 26200.

Calumet Department Head	Date	Calumet School Dean	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date
North Central Department Head	Date	North Central Chancellor	Date
West Lafayette Department Head Jeffrey L. Gray	12/30/09	West Lafayette College/School Dean	3/3/10
West Lafayette Registrar	3/8/10		

OFFICE OF THE REGISTRAR

3/15/10

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Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
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Ind. Study				
Pract/Observ				

Cross-Listed Courses

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		West Lafayette Registrar	Date

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		West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

Engineering Faculty Document No. 37-05
April 27, 2006

TO: The Faculty of the College of Engineering
FROM: The Faculty of the School of Electrical and Computer Engineering
RE: ECE 453 Changes in Course Title, Description, and Requisites

The faculty of the School of Electrical and Computer Engineering has approved the following changes of the undergraduate level course, ECE 453. This action is now submitted to the Engineering Faculty with a recommendation for approval.

From: ECE 453 Introduction to Nanoelectronics

Sem. 1, Class 3, Cr. 3
Prerequisite: ECE 305
Corequisite: ECE 311. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

Introduction to the operating principles of a new class of quantum devices made possible by revolutionary semiconductor fabrication techniques. Quantum concepts are emphasized and specific device examples given.

To: ECE 453 Fundamentals of Nanoelectronics

Sem. 1, Class 3, Cr. 3.
Prerequisite: ECE 305 (may be taken concurrently) and [[MA 266 and MA 265] or MA 262]

The development of nanotechnology has made it possible to engineer materials and devices on a length scale as small as several nanometers. The properties of such nanostructures cannot be described in terms of macroscopic parameters like mobility or diffusion coefficient and a microscopic, or atomistic, viewpoint is called for. The purpose of this course is to convey the conceptual framework that underlies this microscopic viewpoint using examples related to the emerging field of nanoelectronics.

Reason: The course title, description, and requisites have been changed to reflect the updated content of the course.

M. J. T. Smith, Head
School of Electrical and Computer Engineering

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE
ECC Minutes 2/11/09
Date 2/11/09
Chairman ECC R Cipra

ECE 453 Fundamentals of Nanoelectronics

Required Text(s): Class notes

Recommended Reference(s):

1. S. Datta, Quantum Transport: Atom to Transistor, Cambridge University Press (2005), ISBN 0-521-63145-9.
2. MatLab: Student Version, Current Edition, The MathWorks, Inc.

Lecture Outline:

Weeks 1 through 5

1. An atomistic view of electrical resistance
2. Schrodinger equation
   Hydrogen atom, Method of finite differences
3. Self-consistent field / Coulomb blockade
   One-electron versus the many-electron picture
   HW#1, 2, 3, Exam I

Weeks 6 through 10

4. Basis functions
   Converting a differential equation to a matrix equation
5. Bandstructure
   Toy examples, general result, common semiconductors
6. Subbands
   Quantum wells, wires, dots and nanotubes
   Density of states, minimum resistance of a quantum wire
   HW#4, 5, 6, Exam II

Weeks 11 through 15

7. Capacitance: Quantum versus electrostatic
8. Level broadening
   Self-energy, Local density of states, Lifetime, Golden rule
   What constitutes a "contact"?
9. Current-voltage characteristics
   Coherent transport, Transmission, Green's function method
   HW# 7, 8, 9

Exam III (Finals week)

Course outcomes:

1. Ability to perform simple analysis of nanoelectronic devices.
2. Ability to calculate the density of states in nanoelectronic devices.
3. Ability to perform in-depth analysis of nanoelectronic devices.

Assessment Method for Course Outcomes:

Exams I, II and III respectively.

ECE 453 Fundamentals of Nanoelectronics

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   HW# 7, 8, 9

Exam III (Finals week)