Ph. D. in Engineering  
Micro/Nanotechnology and Micro/Nanoelectronics Emphasis  
Recommended Plan of Study (09/2006)

Degree Codes: **ES PhD ENGR**  
Contact: Professor Kody Varahramyan

**General Core Courses**  
Take all three of the following: (9 SCH)
- **ENGR 641** Formulation of Solutions to Engineering Problems (*Fall*)
- **STAT 505** Statistics for Engineering and Science (*Winter*)
- **MATH 574** Numerical Solutions to PDEs (*Spring*)

**Disciplinary (Micro/Nano) Core Courses**  
Take the **first two** and choose **two** from the remaining three: (12 SCH)
- **MSE 501** Fundamentals of Microfabrication Processes
- **MSE 502** Microsystems Principles
- **MSE 504** Advanced Materials for Micro/Nano Devices & Systems
- **MSE 505** Nanotechnology Principles
- **MSE 512** Biotechnology Principles

**Qualifying Examinations**
- **ENGR 685** Doctoral Qualifying Examination
- **ENGR 686** Oral Comprehensive Examination

**Doctoral Seminar: 3 SCH**  
All students are automatically enrolled in the Doctoral Seminar course (ENGR 610) each Fall quarter. 3 SCH of the seminar may be counted towards the degree.

**Independent Study and Special Topics (12 SCH total)**  
At least two Doctoral level Special Topics courses (ENGR 657) are part of the required course work for the degree, for a total of 6 SCH.

A PhD student must participate in 6 SCH of Doctoral Independent Study (ENGR 650) under the supervision of a faculty member. Independent Study can be a preparation for the research leading to the dissertation.

**Recommended Elective courses**
Choose four of the following: (12 SCH)
- **ELEN 535** Advanced Topics in Microelectronics
- **MSE 507/ELEN 537** Advanced Microfabrication with CAD
- **MSE 508/ELEN 538** Advanced Microelectronic Devices with CAD
- **MSE 506** Micro/Nano Scale Materials Measurements & Analysis
- **MSE 557** Special Topics
- **MSE 609** Microsystems Analysis with CAD
- **MSE 610** Microsystems Design with CAD
- **BIEN 557** Special Topics – BioMEMS
- **BIEN 557** Special Topics – Protein Engineering

* Courses not listed are also acceptable, provided they are approved by the Advisory Committee.
CHEM 502  Selected Topics in Organic Chem. - Principles of Polymers
CHEM 523  Nanofabrication by Self-Assembly
CMEN 504  Advanced Chemical Engineering Kinetics
CMEN 513  Transport Phenomena
CMEN 557  Special Topics - Chemical Microsystems
CMEN 557  Special Topics – Nanosystems Modeling
CMEN 557  Special Topics - Thermodynamics
ELEN 533  Optoelectronics
MEMT 511  Modern Engineering Materials
PHYS 512  Solid State Physics
ENGR 566  Quality in Engineering
ENGR 592  Engineering Computational Methods
ENGR 622  The Academic Enterprise
ENGR 631  Global Competitiveness and Management of Technology

Research and Dissertation  18 hours of research and dissertation
ENGR 651  Research and Dissertation

Total: 48 SCH of courses + 18 SCH of Research & Dissertation = 66 SCH.

Research and Dissertation  Minimum 18 hours (ENGR 651).
  3, 6 or 9 hours per quarter. Maximum total allowed is 30 hours.

Total: 48 SCH of courses + 18 SCH of Research & Dissertation = 66 SCH.