Ph.D. in Engineering
Micro and Nanoscale Systems Emphasis
Recommended Plan of Study (August, 2011)

Degree Codes: COES PhD ENGR
Contact: Prof. Palmer

Required General Core Courses
Take all of the following: (9 SCH)

- MATH 574 Numerical Solutions of PDE
- ENGR 641 Formulation of Solutions to Engineering Problems
- STAT 620 Theory of Probability

Micro/Nanotechnology 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)
Students may enroll in 6 SCH or more of doctoral level special topics courses (ENGR 657) as part of the course work for the degree.

Independent study can be a preparation for the research leading to the dissertation.

Recommended Elective courses*
Choose four or more of the following to complete to reach 48 SCH of courses: (12+ SCH)

- BIEN 557 Special Topics – BioMEMS
- BIEN 557 Special Topics – Protein Engineering
- 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
- CHEM 502 Selected Topics in Organic Chem. - Principles of Polymers
- MSNT 506/CHEM 523 Nanofabrication by Self-Assembly
- ELEN 533 Optoelectronics
- ELEN 535 Advanced Topics in Microelectronics
- ENGR 566 Quality in Engineering
- ENGR 592 Engineering Computational Methods
- ENGR 622 The Academic Enterprise
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ENGR 631</td>
<td>Global Competitiveness and Management of Technology</td>
</tr>
<tr>
<td>MEEN 557</td>
<td>Durability of Materials</td>
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<tr>
<td>MEMT 508</td>
<td>Finite Element Analysis</td>
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<td>MEMT 511</td>
<td>Modern Engineering Materials</td>
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<tr>
<td>MSE 506</td>
<td>Micro/Nano Scale Materials Measurements &amp; Analysis</td>
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<tr>
<td>MSE 507/ELEN 537</td>
<td>Advanced Microfabrication with CAD</td>
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<tr>
<td>MSE 508/ELEN 538</td>
<td>Advanced Microelectronic Devices with CAD</td>
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<tr>
<td>MSE 609</td>
<td>Microsystems Analysis with CAD</td>
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<tr>
<td>MSE 610</td>
<td>Microsystems Design with CAD</td>
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<tr>
<td>PHYS 512</td>
<td>Solid State Physics</td>
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<tr>
<td>STAT 621</td>
<td>Theory of Statistics</td>
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*Courses not listed are also acceptable, provided they are approved by the student's advisory committee.

**Research and Dissertation**  
18 SCH  
ENGR 651  
Research and Dissertation

**Total:** 48 SCH of courses + 18 SCH of Research & Dissertation = 66 SCH.  
**Students must also make a B or better in a minimum of 18 SCH of 600 level courses.**