

Graduate Portfolio Program in *Nanomanufacturing*

Brief Description

The graduate portfolio program in nanomanufacturing will provide Ph.D. students with a broad multidisciplinary educational experience that crosses departmental boundaries as well as leadership training. The combined technical and leadership training will ensure that program graduates have the depth and vision to become leaders in nanomanufacturing. Four technical thrust areas have been identified as the essential core for broad mastery of nanomanufacturing. Students will be educated in multiple thrust areas of nanomanufacturing in order to achieve the required multidisciplinary training.

Course Requirements (4 courses plus seminar series)

i. Technical Course Requirements

- 2 courses in one thrust for depth. See thrust areas below.
- 1 course for breadth in another area (separate from above)
- Every portfolio student must take the introductory nanopatterning (ME 397 High Throughput Nanopatterning) for formal education in nanomanufacturing

ii. Non-Technical Course Requirements

1 course in Entrepreneurship, Leadership or Innovation. See approved courses below.

iii. Seminar Requirements

Two semesters of attendance at NASCENT seminar series

Approved Course List

a. (Non-Technical) Entrepreneurship, Leadership and Innovation Courses

- ME 395 Enterprise of Technology (Nichols)
- ME 397 Longhorn Startup Graduate Roadmap (Cox)
- MAN 385.2 The Art of Leadership (Stephens)

b1. Technical Courses (Organized by Departments)

Chemical Engineering:

- ChE 385M Surface Phenomena (Bonnecaze)
- ChE 392 Polymer Science (Paul)
- ChE 395C Chemical Engineering for Micro and Nanofabrication (Mack)
- Computational Design and Optimization of Nanomanufacturing System/Processes (Bonnecaze)

Electrical and Computer Engineering:

- EE 396K Ultra large scale integration techniques (Banerjee/Neikirk)
- EE 396V Carbon-based electronics (Akinwande)
- EE396K Organic and Polymer Semiconductor Devices (Dodabalapur)
- EE396V Semiconductor nanostructures (Tutuc)

- EE396K Nanoscale Device Physics (Lee)

Engineering Mechanics:

- EM 397 Thin Film Mechanics (Lu)

Mechanical Engineering:

- ME 381R – Nanoscale Energy Transport and Conversion (Shi)
- ME 386Q – 14 Electrochemical Energy Materials (Manthiram)
- Intro to Micro and Nanomanufacturing (Li)
- ME 397 High Throughput Nanopatterning (Sreenivasan)

b2. Technical Courses (Organized by Nanomanufacturing Thrusts)

Note: Some of the technical courses fit in more than one nanomanufacturing thrusts.

High-Speed Systems and Metrology:

- ChE 395C Chemical Engineering for Micro and Nanofabrication (Mack)
- EE 396K Ultra large scale integration techniques (Banerjee/Neikirk)
- Intro to Micro and Nanomanufacturing (Li)
- ME 397 High Throughput Nanopatterning (Sreenivasan)

Nano-Enabled Devices:

- EE 396V Carbon-based electronics (Akinwande)
- EE396V Semiconductor nanostructures (Tutuc)
- EE396K Organic and Polymer Semiconductor Devices (Dodabalapur)
- EE396K Nanoscale Device Physics (Lee)
- ME 381R – Nanoscale Energy Transport and Conversion (Shi)

Multi-Scale Modeling and Simulation:

- ChE 385M Surface Phenomena (Bonnecaze)
- ChE 395C Chemical Engineering for Micro and Nanofabrication (Mack)
- Computational Design and Optimization of Nanomanufacturing System/Processes (Bonnecaze)

Integrated Materials and Processes:

- ChE 392 Polymer Science (Paul)
- EE 396K Ultra large scale integration techniques (Banerjee/Neikirk)
- EM 397 Thin Film Mechanics (Lu)
- ME 386Q – 14 Electrochemical Energy Materials (Manthiram)

Sample Program of Work #1

Portfolio student from Mechanical Engineering

Enrollment date: Fall 2015

Portfolio completion date: Spring 2017

List of Portfolio Coursework

- ME 397 High Throughput Nanopatterning
- ME 381R - Nanoscale Energy Transport and Conversion
- ChE 385M Surface Phenomena
- MAN 385 Leadership Development

List of Nanomanufacturing Seminar Series

- Fall 2015 Offering
- Spring 2016 Offering

Summary: This program of work includes the two required components (courses and seminar) and meets the minimum number of four courses. There are two courses from the student's home dept., at least two from outside their department, and the three technical courses are from different thrust areas to ensure multidisciplinary training. In addition, the student satisfies the non-technical and seminar series requirements.

Sample Program of Work #2

Portfolio student from Electrical Engineering

Enrollment date: Fall 2015

Portfolio completion date: Spring 2017

List of Portfolio Coursework

- ME 397 High Throughput Nanopatterning
- ME 397 Longhorn Startup Graduate Roadmap
- EM 397 Thin Film Mechanics
- EE 396V Carbon-based electronics

List of Nanomanufacturing Seminar Series

- Fall 2015 Offering
- Spring 2016 Offering

Summary: This program of work includes the two required components and meets the minimum number of four courses. There is one technical course from the student's home department, at least two from outside their home department, and the three technical courses are from three different thrust areas, ensuring multidisciplinary training. In addition, the student satisfies the non-technical and seminar series requirements.