Materials Science, Engineering, and Commercialization (MSEC)

MSEC 7100. Doctoral Assistant Development.
The course is designed to equip the doctoral students with skills and an understanding of proper procedures to be effective teaching assistants. This course does not earn graduate degree credit, and is graded on a credit (CR), progress (PR), or no credit (F) basis. 1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships about Doctoral Assistant Development

The course is a seminar series exposing students to commercialization issues. The series includes as speakers: successful entrepreneurs, businessmen, research directors, production and process control engineers, intellectual property and licensing experts, management consultants, and technology transfer specialists. Second year students will present business plans that they developed. Repeatable four times for credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Standard Letter about Commercialization Forum

MSEC 7102. MSEC Seminar.
This course is an introduction to current topics through reading of scientific literature with presentations by guest lecturers as the basis for weekly discussions. Students participate by choosing current, high-quality research articles for discussion and will present at least one article during the semester. Repeatable for credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Standard Letter about MSEC Seminar

MSEC 7103. Research in Materials Science, Engineering, and Commercialization.
This research course is for students in Materials Science, Engineering, and Commercialization who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable (with MSEC 7303 hours) for doctoral credit up to 6 hours.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit about Research in Materials Science, Engineering, and Commercialization

Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable for credit. Prerequisite: Acceptance into candidacy.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit about Dissertation in Materials Science, Engineering, and Commercialization

This course includes planning, budgeting, identification of risks and risk mitigation approaches, resource allocation, review of milestones and schedules, and evaluating projects to measure success. Responsibilities of project managers in the areas of problem solving, motivating and managing creative technical staff in project and matrix organizations will be included.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter about Principles of Technical Project Management

Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable for credit. Prerequisite: Acceptance into candidacy.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit about Dissertation in Materials Science, Engineering, and Commercialization

MSEC 7301. Practical Skills in Commercialization and Entrepreneurship.
This course is the first of a two course series to impart business and commercialization skills by producing a business plan. Key areas covered include intellectual property law, technology transfer and licensing strategies, business plan development, business finance strategies, management structures, project management methods, statistical quality and process control.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter about Practical Skills in Commercialization and Entrepreneurship
MSEC 7302. Leadership Skills in Commercialization and Entrepreneurship.
Leadership Skills in Commercialization and Entrepreneurship (3-0). This course is the second of a two course series to impart business and commercialization skills by producing a business plan. Key areas covered include intellectual property law, technology transfer and licensing strategies, business plan development, business finance strategies, management structures, project management methods, statistical quality and process control. Prerequisite: MSEC 7301.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Leadership Skills in Commercialization and Entrepreneurship

MSEC 7303. Research in Materials Science, Engineering, and Commercialization.
This research course is for students in Materials Science, Engineering, and Commercialization who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable (with MSEC 7103 hours) for doctoral credit up to 6 hours.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Credit/No Credit
about Research in Materials Science, Engineering, and Commercialization

MSEC 7304. Collaborative Research/Commercialization Experience.
This course allows Ph.D. level graduate students to initiate, conduct and participate in a collaborative research or commercialization experience with graduate faculty in addition to research conducted under MSEC 7103, MSEC 7303, MSEC 7199 and MSEC 7399. This course recognizes the collaborative nature of the scientific and commercialization enterprise. Repeatable for doctoral credit up to 6 hours.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Credit/No Credit
about Collaborative Research/Commercialization Experience

This course is an in-depth treatment of physical phenomena in nanoscale structures, and consequences for electronic, photonic, mechanical and other types of devices. The course provides a strong background in devices with applications in nanoelectronics, biomedical systems, micro- and nanoscale manipulation, adaptive optics, and microfluidics.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Nanoscale Systems and Devices

MSEC 7311. Materials Characterization.
This course covers skills and knowledge required for microscopy methods including transmission electron microscopy, scanning electron microscopy, scanning tunneling electron microscopy, atomic force microscopy, and confocal microscopy. It covers x-ray and neutron diffraction techniques including structure analysis, powder and glancing angle diffraction, pole figure, texture analysis, and small angle scattering.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Materials Characterization

MSEC 7312. Thermodynamics and Kinetics for Material Scientists.
This course provides a solid understanding of thermodynamics and kinetics of materials, how the rules of thermodynamics and kinetics relate to real-world phenomena, such as phase transformations, phase diagrams, microstructural evolution, and how to use processing to produce a desired microstructure.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Thermodynamics and Kinetics for Material Scientists

MSEC 7315. Quantum Mechanics for Materials Scientists.
This course includes quantum-mechanical foundation for study of nanometer-scale materials, principles of quantum physics, stationary-states for one-dimensional potentials, symmetry considerations, interaction with the electromagnetic radiation, scattering, reaction rate theory, spectroscopy, chemical bonding and molecular orbital theory, solids, perturbation theory, and nuclear magnetic resonance.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Quantum Mechanics for Materials Scientists

MSEC 7330. Computational Materials Science.
Application of computational techniques to molecular and atomic modeling of materials is discussed along with quantum mechanical modeling, density functional theory approaches, forcefield based molecular modeling, mesoscale modeling, energy minimization, molecular dynamics, vibrational spectra, crystal structures, phase equilibria, physical property prediction, and electronic structure related to magnetic and electrical properties. Prerequisite: CHEM 3340 or equivalent.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Computational Materials Science

MSEC 7340. Biomaterials and Biosensors.
The course covers the growing field of biomaterials science including materials for prosthetics and implants, mimetic materials, biosensors, diagnostic devices, and drug delivery systems. Particular attention will be given to nanomaterials for diagnosis and treatment of diseases including targeted cancer treatments, drug delivery systems, and advanced imaging methods.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter
about Biomaterials and Biosensors
MSEC 7350. Frontiers of Nanoelectronics.
This course provides an introduction to the operating principles of nanoscale electronic and optical devices. The emphasis is on how leading edge nano-fabrication technology takes advantage of quantum mechanics of reduced sizes and dimensions. Specific examples of devices based on quantum wells, wires, dots and molecular electronics are given.
about Frontiers of Nanoelectronics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Frontiers of Nanoelectronics

MSEC 7360. Nanomaterials Processing.
The course will cover various aspects of processing of nanomaterials from synthesis through incorporation into consumer goods. Specific topics to be covered in the synthesis of nanomaterials will include CVD, MBE, precipitation, spray drying, hydrothermal, electrochemical, mechanical grinding, phase separation, and shock wave.
about Nanomaterials Processing
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Nanomaterials Processing

MSEC 7370. Advanced Polymer Science.
Advanced topics in polymer science are discussed with a focus on high performance polymers such as high impact, conducting, shape memory, high temperature and the underlying phenomena that provide these unusual properties, and advanced polymer topics areas such as flame retardancy, barrier properties, dielectric properties, rheology, and fiber reinforced composites. Prerequisites: CHEM 5353 or equivalent.
about Advanced Polymer Science
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Advanced Polymer Science

MSEC 7395A. Microwave & Power Device Physics and Materials.
This course will develop an understanding of basic microwave and power device physics and technology and the advanced materials that are used in today's cutting-edge research & development. The primary focus will be on wide bandgap semiconductor materials and devices, and their performance metric versus the industry standard Si-based devices. Prerequisites: MSEC 7401, MSEC 7402 with a B or higher.
about Microwave & Power Device Physics and Materials
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter
about Microwave & Power Device Physics and Materials

MSEC 7395B. Thin Film Photovoltaic Devices.
This course is a survey of the Materials Science of photovoltaic devices with emphasis on device physics including the photovoltaic effect, photon absorption, electrons and holes, generation and recombination, the p-n junction, charge separation, monocrystalline solar cells, thin film solar cells, III-V solar cells, and losses. Prerequisites: MSEC 7401, MSEC 7402 with a B or higher.
about Thin Film Photovoltaic Devices
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter
about Thin Film Photovoltaic Devices

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about Dissertation in Materials Science, Engineering, and Commercialization
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation in Materials Science, Engineering, and Commercialization

MSEC 7401. Fundamental Materials Science and Engineering.
Fundamental Materials Science and Engineering (4-0). Fundamentals of chemical kinetics, physical properties, and continuum mechanics will be discussed. Topics include electronic and atomic structure of solids, structure of crystalline materials, structural imperfections, fundamental thermodynamic and kinetic principles and equations for closed and open systems, statistical models, phase diagrams, diffusion, phase transformations, conservation laws, and continuum kinematics. Prerequisite: Three-week Business Boot Camp or equivalent and Corequisite: MSEC 7312 or equivalent.
about Fundamental Materials Science and Engineering
4 Credit Hours. 4 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Fundamental Materials Science and Engineering

Fundamentals of quantum mechanics, physics of solid state, and physical electronics and photonics for advanced materials will be discussed. Topics will include electronic and atomic structure of solids, lattice vibration, free electron model for magnetism, semiconductors, nanostructures and mesoscopic phenomena, superconductivity, and recent advances in new types of materials. Corequisite: MSEC 7315 or equivalent.
about Advanced Materials Science and Engineering Concepts
4 Credit Hours. 4 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Advanced Materials Science and Engineering Concepts

Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no-credit (F) basis. Repeatable for credit. Prerequisite: Acceptance into candidacy.
about Dissertation in Materials Science, Engineering, and Commercialization
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation in Materials Science, Engineering, and Commercialization
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable for credit. Prerequisite: Admission into candidacy.

6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no–credit (F) basis. Repeatable for credit. Prerequisite: Acceptance into candidacy.

9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit