Texas State University
Doctor of Philosophy (Ph.D.) major in Materials Science, Engineering, and Commercialization

The Materials Science, Engineering, and Commercialization program (MSEC) offers a doctoral degree that will prepare the next generation of scientists and engineers to perform interdisciplinary research on scale-dependent materials and equip them to emerge as effective entrepreneurial leaders in the advancement of high tech 21st century global discovery and innovation.

Admissions Requirements
**All documentation must be submitted to the Graduate College**
- Baccalaureate degree from an accredited college or university
- Master’s degree from an accredited college or university in Biology, Chemistry, Engineering, Materials Science, Physics, Technology, or a closely related field with a minimum grade point average of 3.5 on a 4.0 scale
- ApplyTexas Application and Application Fee
- Official transcripts from each senior level post-secondary institution attended
- Graduate Record Exam (GRE) preferred score of 304 or better (verbal and quantitative combined)
- Test of English as a Foreign Language (TOEFL) score of 550 (paperbased), or 78 (iBT) and section scores of 19/listening, 19/speaking, 19/reading, and 18/writing if applicable
- Letter outlining applicant’s personal history and life goals that are relevant to obtaining a doctoral degree, and in particular, why they want to pursue the commercialization aspect of the MSEC program.
- Three (3) of recommendation evaluating the applicant’s skill and potential to be successful in the Materials Science, Engineering, and Commercialization Ph.D. program
- Current curriculum vita or resume

Note: International students may need to provide additional documents such as financial statements.
**Detailed description of these requirements can be found on our website at [www.msec.txstate.edu](http://www.msec.txstate.edu)**

Deadlines
Application deadline for fall semester is **June 15th (June 1st for International students)**. If the program is not listed as an option on ApplyTexas for a given semester, you may no longer apply for that program, for that semester.

Please submit required admission documents to the Graduate College. Mailing address:

The Graduate College  
Texas State University  
601 University Drive  
San Marcos, TX 78666-4605

If preferred, applicants may electronically submit the documents listed above to the Graduate College at [http://www.gradcollege.txstate.edu/rqmt/doc.html](http://www.gradcollege.txstate.edu/rqmt/doc.html).

Assistantship
If admitted to our program, each **full time student** will be guaranteed two years of salary as long as performance expectations are met. To be eligible for the assistantship, the student must be enrolled in at least nine hours each semester of employment and maintain a minimum 3.0 Texas State grade point average in coursework leading toward the completion of the doctoral degree. For detailed information, go to [http://www.gradcollege.txstate.edu/Prospect_Students/Fin_Grad_Ed/Grad_Assist_Info.html](http://www.gradcollege.txstate.edu/Prospect_Students/Fin_Grad_Ed/Grad_Assist_Info.html)

For more information about our program, visit our website at [www.msec.txstate.edu](http://www.msec.txstate.edu) or contact our office at 512.245.1839.
Summer before Semester 1: Five-day Business Boot Camp

Semester 1
MSEC 7401 Fundamental Materials Science and Engineering (4 Hour Credit)
MSEC 7301 Practical Skills in Commercialization and Entrepreneurship (3 Hour Credit)
MSEC 7101 Commercialization Forum (1 Hour Credit)
MSEC 7102 Materials Science, Engineering, and Commercialization Seminar (1 Hour Credit)

Semester 2
MSEC 7402 Advanced Materials Science and Engineering Concepts (4 Hour Credit)
MSEC 7302 Leadership Skills in Commercialization and Entrepreneurship (3 Hour Credit)
MSEC 7101 Commercialization Forum (1 Hour Credit)
MSEC 7102 Materials Science, Engineering, and Commercialization Seminar (1 Hour Credit)

Summer after Semester 2: Five-day Entrepreneurship Boot Camp

Semester 3
MSEC 7101 Commercialization Forum (Lead) (1 Hour Credit)
MSEC 7102 Materials Science, Engineering, and Commercialization Seminar (Lead) (1 Hour Credit)
MSEC Prescribed Elective(s)

Semester 4
MSEC 7101 Commercialization Forum (Lead) (1 Hour Credit)
MSEC 7102 Materials Science, Engineering, and Commercialization Seminar (Lead) (1 Hour Credit)
MSEC Prescribed Electives

Semester 5
MSEC Prescribed Electives
MSEC 7699 Dissertation in Materials Science, Engineering, and Commercialization (6 Hour Credit)

Semester 6
MSEC 7699 Dissertation in Materials Science, Engineering, and Commercialization (6 Hour Credit)

Semester 7
MSEC 7699 Dissertation in Materials Science, Engineering, and Commercialization (6 Hour Credit)

TOTAL - Minimum required semester credit hours 55

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Suggested Degree Plan for Coursework by Semester
*Individual plans may vary

Prescribed Elective Courses

MSEC 7103 Research in Materials Science, Engineering, and Commercialization
MSEC 7201 Principles of Technical Project Management
MSEC 7303 Research in Materials Science, Engineering, and Commercialization
MSEC 7304 Collaborative Research/Commercialization Experience
MSEC 7310 Nanoscale Systems and Devices
MSEC 7311 Materials Characterization
MSEC 7312 Thermodynamics and Kinetics for Materials Scientists
MSEC 7315 Quantum Mechanics for Materials Scientists
MSEC 7320 Nanocomposites
MSEC 7330 Computational Materials Science
MSEC 7340 Biomaterials
MSEC 7350 Frontiers of Nanoelectronics
MSEC 7360 Nanomaterials Processing
MSEC 7370 Advanced Polymer Science

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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.

MSEC 7101 - Commercialization Forum
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.

MSEC 7102 – Materials Science, Engineering, and Commercialization 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.

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.

MSEC 7199 – 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: Acceptance into candidacy.

MSEC 7201 – Principles of Technical Project Management
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.

MSEC 7299 – 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: Acceptance into candidacy.

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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.

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.

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.

MSEC 7304 – Collaborative Research/Commercialization Experience
This course allows Ph.D. level 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, MSEC 7399 and MSEC 7699. This course recognizes the collaborative nature of scientific and commercialization enterprise. Repeatable (with MSEC 7103 hours) for doctoral credit up to 6 hours.

MSEC 7310 – Nanoscale Systems and Devices
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.

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.

MSEC 7312 – Thermodynamics and Kinetics for Materials 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.

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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.

MSEC 7320 - Nanocomposites
Characteristics of nanoparticles utilized in nanocomposites, techniques for surface modification, methods for nanoparticle dispersion forming nanocomposites, types of nanocomposites, characteristics of nanocomposites, analytical methods for characterization of composites, and common applications will be discussed. Particular attention will be given to the science and theories explaining the unique behavior of nanocomposites.

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.

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.

MSEC 7350 – Frontiers of Nanoelectrics
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.

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.

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 topic areas such as flame retardancy, barrier

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properties, dielectric properties, rheology, and fiber reinforced composites. Prerequisites: CHEM 5353 or equivalent.

**MSEC 7399 – 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.

**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.

**MSEC 7402 – Advanced Materials Science and Engineering Concepts**
Fundamentals of quantum mechanics, physics of solid state, and physical electronics and photonics for advanced materials will be discussed. Topics will include quantum basis for properties 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.

**MSEC 7599 – 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.

**MSEC 7699 – 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.

**MSEC 7999 – 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.

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