

**Tuskegee University**  
**College of Engineering**  
**Master of Materials Science and Engineering**

**Thesis Option (Pages 1-6)**  
**Non-Thesis Option pages (7-12)**

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**Degree Offered:** Master of Science in Materials Science and Engineering (MMSE)

The Department of Materials Science and Engineering at Tuskegee University produces graduates who can be successful in academia, industry and national laboratories. We have assembled a multidisciplinary group of faculty members with expertise in various aspects of synthesis, processing, modeling and characterization of

**Admission Requirements:**

Applicants must have completed the B.S. degree from a department of approved standing and granted by an accredited college or university in any of the following areas to be considered for the Master's degree program in Materials Science and Engineering:

Engineering

to meet the prerequisite requirements.

- Applicants must also have a cumulative GPA of 3.0 or better. Demonstration of competency in mathematics, by passing courses up to and including Calculus III, is required. An applicant may be admitted conditionally if he/she has not completed Calculus III. Upon completion of the mathematics requirement, the "conditional admission" will be changed to "full admission".
- The minimum acceptable combined GRE score is 1000 (old) or 300 (new).
- Official Transcript from all colleges/universities attended (International Students must have transcripts translated through World Education Services-WES)

**Graduation Requirements: 30 credits**

Core Courses: 12 credits

Elective Courses: 12

Credits Thesis: 6 credits

Admission to Candidacy

Passing of the Final Oral Examination

**Advisory Committee:**

During the first semester of his/her study in the MSMSE program, the student and his/her Major Professor must recommend to the Head of the Department for approval, the student's Advisory Committee consisting of a Minimum of four members including the Major Professor and the Head of the Department. The Advisory Committee shall also serve as the Examination Committee.

**Core Courses (12 credits): Required for All Students in the Master's program**

MSEG 0516: Advanced Strength of Materials 3 credits (MENG 0316 & Calculus III)

MSEG 0518: Advanced Materials Science and Engineering 3 credits (MENG 0318 & Calculus III)

MSEG 0521: Polymer Science and Engineering 3 credits

MATH 0561: Applied Mathematics I 3 credits

**Elective Courses (12 credits):****Determined by the MSE Department Head**

Elective courses will be those approved by the Head of the MSE Department, from the list attached.

**Transfer Credits:**

The student's Advisory Committee may recommend transfer credits for up to 9 hours for graduate courses taken by the student at Tuskegee University as part of another graduate program or at any other institution. Transfer credits may be recommended under both core and elective categories.

**Admission to Candidacy:**

Immediately after completing 15 credit hours of course work, including transfer credits, the student must submit to the Dean of the Graduate School, a completed application for the Candidacy for the degree.

**Seminars**

A student pursuing the Master of Science degree in Materials Science and Engineering must present at least two seminars. The first seminar shall be the presentation of the student's research proposal of the Master's thesis. The second or the final seminar shall be his/her Final Oral Examination for the degree. The student is also required to participate in all seminars arranged by the department.

**Thesis**

The final draft of the thesis must be filed with the student's Advisory Committee at least 30 days before the date listed in the university calendar for final copies to be submitted during the semester in which the student expects to graduate. The student must present to the Dean of Graduate Programs a "Preliminary Approval Sheet" (PAS) bearing the signature of the Major Professor before the final oral examination may be scheduled

and before copies of the thesis/dissertation are distributed to members of the Examining Committee. After the “Preliminary Approval Sheet” has been signed, it should be submitted to the Dean of Graduate Programs before the final examination is scheduled and before the final draft of the thesis/dissertation is prepared for final approval. Approval of the thesis/dissertation in its final form rests with the Examining Committee.

**Transition from Thesis to the Non-Thesis Option:**

Based on the performance of the student in research, the Department Head may recommend the student to transition to the non-thesis option. Such student should complete all the requirements of the MMSE non-thesis option.

**LIST OF CORE COURSES**

MSEG 0516	<p><b>ADVANCED STRENGTH OF MATERIALS. CR. 3.</b>            A continuation of the undergraduate course in Strength of Materials (MENG 0316). Emphasis is placed on stress-strain relationships, failure behavior, yield and fracture under combined stresses fracture toughness of cracked members, fatigue crack growth, creep and damping; and on determination of static and dynamic mechanical properties through laboratory experiments.  <b>Prerequisite: MENG 0316 and Calc III</b></p>
MSEG 0518	<p><b>ADVANCED MATERIALS SCIENCE AND ENGINEERING. CR. 3.</b>            A continuation of the undergradu</p>

MSEG 0502

**BIOMATERIALS SCIENCE AND ENGINEERING.CR. 3.** Introduce principles and applications of natural and synthetic biomaterials for medical applications. Design, synthesis and characterization of biomaterials, analysis, including microscopy, spectroscopy and Mechanical strength analysis. Importance of biocompatibility of materials in terms of immune response, cell interaction, toxicity and sensitivity.

PHYS 0511

MATH 0562	<b>APPLIED MATHEMATICS II.</b> 2nd Semester, Summer on Demand. Lect. 3, 3 credits. Special functions; partial differential equations; characteristics; solutions of Laplace, Helmholtz, wave and heat equations; boundary conditions and eigenfunctions; Sturm-Liouville problems; Green's function. <b>Prerequisite: Minimum grade of "C" in MATH 0461 or Departmental Approval.</b>
EENG 0578	<b>ELECTRONIC DEVICE DESIGN AND FABRICATION.</b> 1st Semester. Lect. 3, Lab 0, 3 credits. Monolithic IC technology; Bipolar and MOSFET processes and structures; Layout design, fabrication, applications. <b>Prerequisite: EENG 0413 or Permission of Instructor</b>
MSEG 0601	<b>PHYSICS OF MATERIALS.</b> CR. 3. To gain an understanding of the nature of materials based on the physical principles on which the properties of materials depend. The basic relationships introduced in undergraduate physics and chemistry courses are extended using the concepts of quantum mechanics to relate the properties of materials to their internal structure and external environment. Optical, electrical, thermal and magnetic properties of metals, semiconductors and insulators will be covered.

MSEG 0603

MSEG 0623	<b>THEORY OF ELASTICITY.</b> CR. 3. Stress-Strain relations, strain energy, general methods of elasticity, reciprocal theorems, energy methods and variational principles. The Rayleigh-Ritz and Galerkin methods. Finite difference and relaxation method. Tensor application. <b>Prerequisites: MENG 0416 and MATH 0461. Graduate Standing.</b>
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MSEG 0624

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Engineering**

**Non-Thesis Option**

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Core Courses: 12 credits

Elective Courses: 18 credits

Admission to Candidacy

**Core Courses (12 credits): Required for All Students in the Master's program MSEG**

0502: Biomaterials Science and Engineering 3 credits

MSEG 0516: Advanced Strength of Materials 3 credits (MENG 0316 & Calculus III)



MSEG 0518	<p><b>ADVANCED MATERIALS SCIENCE AND ENGINEERING. CR. 3.</b>  A continuation of the undergraduate course in Materials Science and Engineering (MENG 0318). Emphasis is placed on the properties and processing methods of classic and modern materials. Application, degradation, selection, design consideration, economic, environmental and societal issues of these materials. Use of microscope to verify materials microstructure and defects through laboratory experiments. <b>Prerequisite: MENG 0318 and Calc III</b></p>
MSEG 0521	<p><b>POLYMER SCIENCE AND ENGINEERING. CR. 3.</b> Introduce the concepts of polymer science and engineering; chain structure and configuration; molecular weights and sizes, concentrated solutions and phase separation behavior; the amorphous state; viscoelasticity and rubber elasticity; transitions and relaxations; crystalline state of polymers; morphology of crystalline polymers.</p>

### LIST OF ELECTIVE COURSES

MSEG 0501 **MATERIALS AND SOCIETY. CR.3.** Introduce students to how new materials impacted social structure both historically and in the present day, and to the social and cultural forces that shape the development and use of materials and technologies from the past to future. Demonstrate how

MENG 0550 **ADVANCED THERMODYNAMICS**. CR. 3. A statistical approach to the study of the first and second laws, thermodynamics relations for the pure substance, application to Clausius inequality and

MSEG 0612	<p><b>NANOSCALE SCIENCE AND ENGINEERING.</b> CR. 3. This course aims to introduce students to nanoscale materials science and technology. It will cover topics such as nanoscale material synthesis, properties, and applications. It will also emphasize the theory, modeling and simulation approaches used to understand the synthesis mechanisms and morphological changes in nanoscale materials systems, as well as the properties of materials at the nanoscale. The course will have a balanced materials science (main thrust of the course) mechanics, physics and chemistry and technology flavor.</p> <p><b>Prerequisites: graduate standing or senior undergraduate</b></p>
MSEG 0614	<p><b>MATERIALS AND ENVIRONMENT.</b> Cr.3. The impact of the environment on polymeric, metallic and ceramic materials is examined. Mechanisms of interaction between materials and the environment are considered. The effects of heat, moisture, UV light, ozone, radiation, acid rain and corrosive environments are included in this study of the effect of the environment on materials. The</p>

MSEG 0640	<b>NON-DESTRUCTIVE EVALUATION TECHNIQUES.</b> Cr. 3. Basics of NDE of metals and advanced materials, ultrasonics, modal analysis, acoustic emission, acousto-ultrasonics, acoustic impact testing, X-ray radiography. Eddy-current testing, and laser measurements.
MSEG 0641	<b>COMPOSITE MATERIALS.</b> CR. 3. Introduction to composite materials; fibers, matrix and interface; mechanical and chemical aspects; design, chemical synthesis, manufacturing and processing methods; mechanical testing methods; understanding of failure mechanisms based on static, fatigue, impact and other properties; microstructural consideration. <b>Prerequisite: MENG 0318</b>
MSEG 0642	<b>MECHANICS OF COMPOSITES.</b> CR. 3. Classification and characterization of composite materials; mechanical behavior of composite materials; stress-strain relation for anisotropic materials; invariant properties of an orthotropic lamina; strength concepts and biaxial strength theories; classical lamination theory and theory of an anisotropic elastic continuum; equations of laminated anisotropic plates. <b>Prerequisite: MSEG 0641</b>
MSEG 0690	<b>SPECIAL TOPICS.</b> Cr. 3. Advanced topics in materials science and engineering ( <b>prerequisite: Graduate standing and approval of major professor and instructor</b> ).
MSEG 0701	<b>CONTINUOUS REGISTRATION.</b> Cr. 0.
MSEG 0702	<b>CANDIDATE FOR DEGREE.</b> Cr. 0.

*Additional details that are not shown in this document may be found on the website of the Department of Materials Science and Engineering and in the TU's Graduate Handbook.*