

THEORETICAL & APPLIED MECHANICS, PHD

for the degree of Doctor of Philosophy in Theoretical & Applied Mechanics

The PhD in Theoretical and Applied Mechanics (TAM) in the Department of Mechanical Science and Engineering is one of the only of its kind in the world, offering a rigorous curriculum with structured core and breadth required courses. These course requirements ensure all TAM graduate students develop a strong and broad foundation in mechanics as well as applied mathematics.

Opportunity exists for specializing in i) biomechanics via the Biomechanics (<http://catalog.illinois.edu/graduate/engineering/concentration/biomechanics/>) optional graduate concentration, ii) cancer nanotechnology via the Cancer Nanotechnology (<http://catalog.illinois.edu/graduate/engineering/concentration/cancer-nanotechnology/>) optional graduate concentration, and iii) computational science and engineering via the Computational Science & Engineering (<http://catalog.illinois.edu/graduate/engineering/concentration/computational-science-engineering/>) optional graduate concentration.

Admission Requirements

An applicant for admission to the Department of Mechanical Science and Engineering must:

1. Be a graduate of an institution awarding a baccalaureate degree equivalent to that granted by the University of Illinois at Urbana-Champaign;
2. be adequately prepared for advanced study as demonstrated by his or her previous program of study and scholastic record; and
3. be recommended for admission by the Department of Mechanical Science and Engineering. A minimum grade point average of 3.25 (A = 4.00) for the last two years of undergraduate study is required, and a minimum grade point average of 3.50 (A = 4.00) is required for any previous graduate work completed.

Currently the Graduate Record Examination (GRE) (<http://www.ets.org/>) is not required for the admissions application, but a student may elect to submit their scores.

All applicants whose native language is not English are required to submit TOEFL (<http://www.toefl.org/>) or International English Language Testing System (IELTS) (<http://www.ielts.org/>) scores as evidence of English proficiency. Minimum admission requirements (<https://grad.illinois.edu/admissions/instructions/04c/>) are set by the Graduate College.

The Department of Mechanical Science and Engineering accepts PhD applications for both Spring and Fall terms.

For detailed information, please see our admissions requirements webpage (<https://mechse.illinois.edu/graduate/applying-mechse-graduate-programs/>).

Financial Aid

Students admitted to the PhD program are eligible for Board of Trustees (BOT) tuition-waiver generating appointments at the University of

Illinois, including research assistantships, teaching assistantships, and fellowships. Starting in Fall 2020, Grainger Engineering PhD students in their first five years of enrollment who meet the minimum eligibility requirements (<https://grainger.illinois.edu/academics/graduate/phd-funding-guarantee/>) are guaranteed a funded appointment for fall and spring that includes a full tuition waiver, a partial fee waiver, and a stipend.

All applicants whose native language is not English, regardless of US citizenship, who wish to be considered for teaching assistantships must demonstrate spoken English language proficiency (<http://grad.illinois.edu/admissions/taengprof.htm>) by achieving a minimum score of 24 on the speaking subsection of the TOEFL iBT or 8.0 on the speaking subsection of the IELTS. Students who are already at Illinois may request to take the on-campus EPI test (http://cte.illinois.edu/testing/oral_eng/epi_overview.html), for which the minimum passing score for TA eligibility is 4CP. All new teaching assistants are required to participate in the Graduate Academy for College Teaching (<https://citl.illinois.edu/citl-101/teaching-learning/grad-academy-for-college-teaching/>) prior to the start of their first semester as a teaching assistant.

Graduate Teaching Experience

Although teaching is not a general Graduate College requirement, experience in teaching is considered an important part of the graduate experience in both the ME and TAM PhD programs. The TAM PhD requires that one semester of teaching assistantship be completed during the program.

Department Research

A new paradigm in research is being created in the department by integrating basic sciences such as biology, chemistry, applied mathematics, and applied physics with the traditional mechanical engineering and engineering mechanics disciplines of fluid mechanics/thermal sciences, solid mechanics/materials and controls/dynamics. This integration is fostering new directions and discoveries in nanomechanics, nanomanufacturing, biomechanics and computational science and engineering.

The goal of all research in the department is to address critical societal problems in the areas of health, security/defense, energy/environment, manufacturing, and transportation. While the basic function of departmental research is generation of new knowledge, a growing number of projects are prompted by current needs of the state of Illinois, the United States, and the world. For more information, see the department's research Web site (<https://mechanical.illinois.edu/research/>).

MechSE faculty are major participants in activities at the department, college, and university level via research centers and programs that are integral to the MechSE graduate program. For more information, see the department's research centers Web site (<https://mechanical.illinois.edu/mechse-research-centers/>).

MechSE's wealth of research laboratories allows faculty, graduate and undergraduate research assistants, and postdoctoral and visiting scholars to conduct theoretical and experimental investigations of phenomena related to materials behavior, combustion, micro- and nanomechanical systems, controls and dynamics, thermodynamics, biomechanics, and much more. For more information, see the department's research laboratories Web site (<https://mechanical.illinois.edu/research/mechse-laboratories/>).

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Candidates for the Doctor of Philosophy degree are required to complete a minimum of 32 graduate hours of course work beyond the bachelor's degree with a minimum grade point average of 3.0.

Acceptance into the doctoral program requires good academic standing and successful completion of a Qualifying Examination (<http://mechanical.illinois.edu/graduate/phd-programs/#PhDTAM>), which is the defense of a scholarly work, such as a master's thesis. A student must also pass an oral preliminary examination based on the proposed thesis work.

For more details of the degree requirements for the Ph.D. program, visit the department's Graduate Program Website (<http://mechanical.illinois.edu/graduate/mechse-graduate-degrees/>) and the Graduate College Handbook (<https://grad.illinois.edu/gradhandbook/>).

Requirements

Code	Title	Hours
TAM 599	Thesis Research (min-max applied toward the degree)	32-64
TAM 500	Seminar (registration for 1 hour every term while in residence; credit does not apply toward the degree)	0
Elective courses beyond core and breadth – chosen in consultation with advisor (subject to Other Requirements and Conditions below)		0-32
Credit for minimum of 16 hours of TAM breadth courses from a departmental list, or equivalent as evaluated by the Associate Head for Mechanics.		
Course work is required from each of the following major areas, totaling 16 hrs: 2 courses total from applied mathematics, fluid mechanics, and solid mechanics, 1 course in mechanics of materials, and at least 1 course in either computational mechanics or experimental mechanics.		
Total Hours		96

Other Requirements and Conditions

Requirement	Description
Other Requirements and Conditions may overlap	
Credit for TAM 531 or 532, 541, 542, 551 or equivalent as evaluated by the Associate Head for Mechanics	
A 25% or more teaching assistantship for at least one semester.	
Continuous registration is required after the preliminary exam and until thesis deposit, while on campus and during semester of final defense.	
MSE 492 Lab Safety Fundamentals	
Ph.D. exam and dissertation requirements:	
Qualifying exam	
Preliminary exam	

Information listed in this catalog is current as of 03/2023

Final exam or dissertation defense

Dissertation deposit	
Minimum GPA:	3.0

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Illinois MechSE TAM graduates will have:

1. A thorough understanding of the fundamentals of the engineering disciplines, namely, solid mechanics, fluid mechanics, and applied mathematics (core requirements). [MS/PhD]
2. A broad understanding of the various foundations of the engineering disciplines, including computational mechanics, mechanics of materials, biomechanics, dynamics, and nanomechanics (in the PhD program, breadth requirements). [MS/PhD]
3. Ability to identify relevant research subjects, outline strategies of inquiry, and demonstrate potential to bring the relevant research to completion. [MS/PhD]
4. Ability to communicate research results to scientific audience in conferences. [MS/PhD]
5. Ability to document research outcomes comprehensively for publication. [MS/PhD]

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Other Graduate Programs in the Department of Mechanical Science & Engineering

- degree programs
 - Mechanical Engineering, MENG (<http://catalog.illinois.edu/graduate/engineering/mechanical-engineering-meng/>)
 - optional concentrations:
 - Biomechanics (<http://catalog.illinois.edu/graduate/engineering/concentration/biomechanics/>)
 - Cancer Nanotechnology (<http://catalog.illinois.edu/graduate/engineering/concentration/cancer-nanotechnology/>)
 - Mechanical Engineering, MS (<http://catalog.illinois.edu/graduate/engineering/mechanical-engineering-ms/>)
 - Mechanical Engineering, PhD (<http://catalog.illinois.edu/graduate/engineering/mechanical-engineering-phd/>)
 - Theoretical & Applied Mechanics, MS (<http://catalog.illinois.edu/graduate/engineering/theoretical-applied-mechanics-ms/>)
- optional concentrations for MS and PhD programs:
 - Biomechanics (<http://catalog.illinois.edu/graduate/engineering/concentration/biomechanics/>)
 - Cancer Nanotechnology (<http://catalog.illinois.edu/graduate/engineering/concentration/cancer-nanotechnology/>)
 - Computational Science & Engineering (<http://catalog.illinois.edu/graduate/engineering/concentration/computational-science-engineering/>)

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Department of Mechanical Science and Engineering

Department Head: Anthony Jacobi (a-jacobi@illinois.edu)

Director of Graduate Studies: Petros Sofronis

Mechanical Science and Engineering website (<https://mechanical.illinois.edu/>)
Mechanical Science and Engineering program website (<https://mechanical.illinois.edu/graduate/graduate-degree-programs/phd-programs/>)
Mechanical Science and Engineering faculty (<https://mechanical.illinois.edu/people/>)
168 Mechanical Engineering Bldg, 1206 W Green St, Urbana, IL 61801
(217) 300-6722
Mechanical Science and Engineering email (mehcse-grad@illinois.edu)

Grainger College of Engineering

Grainger College of Engineering website (<https://grainger.illinois.edu/>)

Admissions

Contact: Amy Cates (acate2@illinois.edu)
Departmental Admissions & Requirements (<https://mechanical.illinois.edu/graduate/applying-mechse-graduate-programs/>)
Graduate College Admissions & Requirements (<https://grad.illinois.edu/admissions/apply/>)