GUIDE TO GRADUATE STUDY AND DEGREE PROGRAMS

IN

MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING
LOUISIANA STATE UNIVERSITY
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This handbook is for the graduate students and faculty of the MECHANICAL ENGINEERING Program. Policy changes may occur at any time. Students are responsible for checking with the MIE Graduate office and/or Graduate Advisor for updates. Mechanical Engineering Program Policies have been worked out by the graduate studies committee and approved by the Mechanical Engineering Graduate Faculty of the Department.

Revised in February 2023

General Description

The Department of Mechanical & Industrial Engineering (MIE) is one of seven engineering departments at LSU. In the Mechanical Engineering (ME) program of the MIE department, there are currently 26 full-time faculty members. Graduate student enrollment, including both mechanical engineering and engineering science students supervised by the ME faculty, is about 60, nearly two-thirds of whom are in the Ph.D. program.

Mechanical Engineering faculty members span general areas of expertise ranging from the traditional ones such as mechanical systems (design & control), materials science & engineering, and thermal-fluid science and combustion, to more novel ones such as micro/nano-systems (design and fabrication) and molecular-level engineering. The ME faculty is primarily involved in research related to Energy, Materials & Manufacturing, Aerospace and Bio-Technology applications. Research is funded through grants from federal agencies (NSF, NASA, DoD, DoE, NIH etc.), state government (Louisiana Board of Regents), national laboratories, and various industries. The graduate faculty works closely with graduate students in research projects that cover both traditional and nontraditional areas. Graduate students are engaged in experimental, numerical, and modeling studies and can select their coursework from mechanical engineering and other departments, in consultation with their advisory committees. Students have access to excellent laboratory facilities and equipment, as ans, DoE, NI

ME Graduate Faculty

By Appointment Rank

Full Professors

eligibility for a graduate assistantship may be found in PS-21, and on the Graduate School on-line Catalog @ https://catalog.lsu.edu/index.php

M.S. Degree (Thesis Option)

To receive an M.S. degree from the ME program, you must satisfy the M.S. degree requirements, as specified in the current *General Catalog.* The additional departmental requirements listed here provide background in the fundamentals of mechanical engineering, while allowing you the flexibility to specialize in thermal systems, mechanical systems, materials science, and engineering or micro-systems.

1. Major Professor and Graduate Advisory Committee

Upon entering the program, you need to identify a major professor from the area in which you intend to specialize. Once you do this, you will meet with the professor and finalize this arrangement with an official binding agreement. In consultation with your major professor, your program advisory committee is named. The major professor and the members of your Graduate Program Committee constitute your Advisory Committee. While joining the graduate program, you and the graduate advisor or your major professor will devise an initial plan of study that constitutes the intended courses that you will take for the M.S. degree, which must be approved by your Graduate Advisory Committee. For the remainder of your degree program, you will follow this plan. Your plan of study can be altered at any time only upon approval of your Advisory Committee; you will need to resubmit a ñPlan of Studyò form for any changes made to your course work.

The Advisory Committee must have a minimum of three faculty members, including two from the ME program of the MIE Department. One member can be from another department. The Advisory Committee must be composed of members of the Graduate Faculty, including at least one full member of the graduate faculty from the ME program of the MIE Department.

2. Course Work

(24 hours minimum of lecture courses plus 6 hours of thesis research)

Course offerings are listed in the LSU Catalog. A petition to waive any of the requirements in this section

he/she has successfully defended his/her thesis, or while he/she is participating in an out-of-state internship or out-of-state student exchange program under approval of his/her major professor. If this condition is met for an entire semester, the registration requirement is waived.

- Take a minimum of six hours of ME 8000
- Your major professor and advisory committee must approve all course selections.
- You are required to present your research results at a departmental forum before graduation, usually during your final semester in residence. This is done in the departmental, annual Graduate Student Research Conference (GSRC), prior to graduation.
- The list of approved core courses follows:

Thermal Sciences

ME 4353	Advanced Engineering Thermodynamics
ME 7313	Advanced Fluid Dynamics I
ME 7323	Advanced Fluid Dynamics II
ME 7333	Hydrodynamic Stability
ME 7343	Computation of Fluid Flow & Heat Transfer
ME 7433	Heat Transfer I
ME 7443	Heat Transfer II

Mechanical Systems

ME 4273	Stress Analysis in ME
ME 4143	Vibrations
ME 7153	Advanced Vibrations
ME 7163	Advanced Dynamics
ME 7273	Advanced Stress Analysis in ME
ME 7633	Advanced Engineering System Dynamics
ME 7673	Advanced Mechanical Systems Control

Materials Science and Engineering

ME 4723	Advanced Methods of Material Characterization
ME 4733	Deformation and Fracture of Engineering Materials
ME 7723	Electron Beam Characterization of Materials (TEM course)
ME 7743	Defects, Diffusion, & Transformation in Solids*
ME 7753	Thermodynamics of Solid Materials *

For the Materials Minor, we have:

ME 4723	Advanced Methods of Materials Characterization
ME 4743	Kinetics of Materials
ME 4733	Deformation and Fracture of Engineering Materials

* Required for all Materials Majors

Take one course from the following list of basic Math courses:

MATH 4038	Mathematical Methods in Engineering
MATH 4340	Partial Differential Equations
MATH 4036	Complex Variables
ME 7533	Numerical Methods in Applied Mechanics

3. Thesis and Final Examination

The masterís thesis should demonstrate your capacity for research, originality of thought, and facility in organizing materials. An open, announced, oral presentation of the thesis and a ñdefenseò examination is required after completion of writing of the thesis. The exam part is to be administered by the studentís advisory committee in a closed session for privacy purposes.

- A request for the final examination must be submitted to The Graduate School with the graduate advisorís approval at least three weeks prior to the proposed examination date or by the current semester deadline, if the student is a candidate for a degree (see the Graduate School calendar for all pertinent dates on the Graduate School web-site).
- The examining committee must have copies of the thesis at least two weeks prior to the final examination. The thesis

- Take 3 credit hours of a Math course
- Take 21 credit hours of technical elective courses (selected by student/major professor/advisory committee)
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- Minimum GPA of at least a 3.0 every semester unless you are receiving a scholarship or fellowship in which a higher GPA average will be required (for example, EDA Fellows should maintain a minimum of a 3.5 average)

3. Ph.D. Qualifying/Comprehensive Examinations

Other Requirements - Check with the Graduate Administrative Coordinator and the Graduate School regarding other requirements regarding electronic submission of dissertation, payment of fees, etc. Also, leave your future contact address with the graduate administrative coordinator. Keep in touch with your home department and Alma Mater, and inform us of your professional affiliation and growth in your career.

Other Programs

Interdisciplinary Programs

The College of Engineering offers programs leading to two interdisciplinary graduate degrees:

- Master of Science in Engineering Science
- Doctor of Philosophy in Engineering Science

These programs provide a mechanism for one to pursue advanced study in interdisciplinary fields, not covered by the graduate programs administered by individual departments of the college, such as Materials Science, Environmental Science, etc. The Associate Dean for Research and Graduate Activities of the College of Engineering administers these programs by keeping records of all students enrolled in interdisciplinary studies and by acting as coordinator for admissions decisions and as Program chairman of record on all documentation.

To participate in any of these programs, contact the Associate Dean for Research and Graduate Activities of the College of Engineering, as well as appropriate faculty within the ME program of the MIE Department. In general, these individuals, along with your advisory committee determine admission requirements, program of study, and examinations.

Mechanical Engineering as Minor

If you are a Ph.D. candidate in another doctoral program and wish to select mechanical engineering as a minor area; the requirements are:

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Appendix: Graduate Courses Offered

(Note) The course information described here may be changed at any time without notice. For the most updated information, students are required to consult the Graduate catalog. (https://catalog.lsu.edu/index.php)

4143 Mechanical Vibrations (3) ***Prereq.: CE 3400, MATH 2070, ME 3143, and 4133; or equivalent.*** Basic principles of oscillating mechanical systems; single and multiple degrees of freedom; dynamic balancing; applications to mechanical systems; continuous systems vibrations.

4163 Intermediate Dynamics (3) F ***Prereq.: MATH 2070 and ME 3133***. Rotating reference frames, rigid body kinetics in three dimensions, central force motion, variable mass problems, and Lagrange's equations.

4183 Theory and Design of Mechanical Control Systems (3) ***Prereq.: MATH 2090, ME 3143 and credit or registration in ME 3603.*** Basic principles, concepts, characteristics and performance of linear feedback control systems; stability of linear systems; frequency response methods; compensator design in the frequency domain.

4213 Welding Engineering I (3) ***Prereq.:***
Fundamentals of welding and joining; introduction to nondestructive evaluation; basics of welding technology and welded structures; GMAW and GTAW; shielded metal arc welding processes.

4223 Welding Engineering II (3) ***Prereq.: ME 2723 or ME 2733; ME 3633; ME 4213 or consent of instructor; grade of*** Fundamentals and intermediate level welding and joining; intermediate nondestructive evaluation empd GTAW; shi

4633 Internal Combustion Engines (3) ***S Prereq.: ME 2334 or 3333 or equivalent.*** Classification of internal combustion

4913 Aerodynamics (3) ***Prereq.: ME 2334, ME 3834, or graduate standing.*** Fundamental principles and concepts of aerodynamics; inviscid incompressible and compressible flow; and viscous flow phenomena.

4923 Jet and Rocket Propulsion (3) ***Prereq.: ME 2334 and ME 3834.*** Propulsive systems; aerothermochemistry; air-breathing propulsion; rocket propulsion.

4933 Advanced Topics in Mechanical Engineering, (3) ***May be taken for a max. of 6 hrs. of credit when topics vary. Two sections may be taken concurrently.***

4943 Special Problems in Aerospace Engineering (3) ***Prereq.: Senior standing in mechanical engineering or related discipline. May be taken for a max. of 12 sem. hrs. of credit when topics vary.*** Aerodynamic problems of special interest in the analysis and design of water, land, air, and space transportation systems.

4953 Nuclear Reactor Engineering Design (3) ***Prereq.: PHYS 2101 and PHYS 2102 or equivalent and credit or registration in ME 4433.*** Characteristics of radioactive materials, neutron interactions, the fission process; static criticality, time-dependent behavior of cores and design of nuclear power reactors.

4963 Nuclear Reactor Systems Engineering (3) ***Prereq.: ME 4953 or equivalent.*** Engineering aspects of reactor systems; nuclear fuel cycles, isotope separation, mechanical and thermal design, selection of materials and environmental impact of nuclear facilities.

4973 Space Systems (3) ***Prereq.: ME 3133 and credit or registration in ME 4143.*** Design of spacecraft for orbital operations, space exploration, and human spaceflight; includes mission requirements; astrodynamics; atmospheric entry; top-level design of power; propulsion; altitude determination and control; communications; thermal management; life support; reliability; cost and scheduling; political, commercial, and national security aspects of spaceflight.

7163 Advanced Dynamics (3) ***Prereq.: a first course in engineering dynamics, and a course in differential equations.*** Rotating reference frames, rigid body kinetics in three dimensions, central force motion, orbital mechanics, variable
ons.

7153 Advanced Vibrations (3) ***Prereq.: ME 4143 or equivalent.*** Modeling and response of continuous vibratory systems; inverse problems in vibration; active vibration control; dynamic absorption; wave propagation and reflection; numerical methods for continuous systems.

7273 Advanced Stress Analysis in Mechanical Engineering (3) *Prereq.: ME 4273.* The nature and limitations of the underlying theory in stress analysis. Computation of verified stresses for properly posed problems using finite element analysis.

7313 Advanced Fluid Dynamics I (3) ***Prereq.: credit or registration in MATH 4038 or equivalent.*** Cartesian tensors; kinematics of fluid motion; mass and momentum conservation equations for Newtonian fluids; vorticity dynamics; irrotational incompressible flow; dynamic similarity and scaling analysis; laminar flow; compressible flow.

7323 Advanced Fluid Dynamics II (3) ***Prereq.: ME 7313 or equivalent.*** General conservation laws and Navier-Stokes equations; incompru10.5 Tf1 0 equations; inc5eMp u0.q0.00000912 0 612 792 reW*nBT/F3 10.5 Tf1 0 0 1 36.025 296.35 Tm0 g0 G