

MAE Qualifying Examination

Ph.D. Qualifying Examination requirements, schedule, organization, and oversight

Students admitted to the Ph.D. program in MAE Department at the University of Central Florida are required to pass the Ph.D. Qualifying Examination in order to remain in the program and proceed to the next step which is the candidacy examination. As such, the Ph.D. Qualifying examination is an entrance examination that qualifies the student to remain in the program and pursue his/her dissertation.

Requirement: Students who entered the Ph.D. program in the MAE Department at the University of Central Florida are required to pass the Ph.D. qualifying exam at/or before:

- a. the first semester of their third year (fifth regular (F/Sp) semester) of graduate school at UCF for students entering directly with a B.S. degree
- b. the first semester of the second year of graduate school at UCF for students entering with an M.S. degree from UCF or elsewhere.

Sign up and exam administration schedule: Ph.D. Qualifying Examinations are administered twice during the academic year.

- a. Fall Semester:
 1. May 1st: Deadline for students to sign up for the qualifying examination.
 2. February 15th: Qualifying examination committees and chairs are announced.
 3. March 15th: completed subject examinations are due to the GSC. Each subject is designed for a 2- to 3- hour exam time.
 4. Week after Labor Day: Qualifying examination is administered. Exam is administered one morning session from 9:00 am – 12:00 pm and one afternoon session from 1:00 pm - 4:00 pm.
- b. Spring Semester:
 1. August 1st: Deadline for students sign up for the qualifying examination.
 2. September 15th: Qualifying examination committees and chairs are announced.
 3. March 7: completed subject examinations are due to the GSC.
 4. Week after MLK Day: Qualifying Examination is administered. Exam is administered one morning session from 9:00 am – 12:00 pm and one afternoon session from 1:00 pm - 4:00 pm.

Organization and oversight: The MAE Graduate Studies Committee (MAE GSC) oversees the administration and coordination of the Qualifying Examination. The examining committees for the Qualifying exam subjects will be appointed by the appropriate program area chairs (Thermo-fluids, Solid Mechanics, Mechanical Systems & Controls, and Aerospace). Students will select three subjects in which they are to be examined chosen from the list provided on page 4. Each subject exam will be *closed book and notes* and will be of *2-hour* duration. Each subject exam will be prepared by a committee of three examiners, one of whom is designated as chair, and appointed for a year by the appropriate division chairs on request from the MAE GSC. The chair of the subsequent year subject exam will be rotated from the current year's committee. The subject committee will prepare, grade, and determine the pass/fail status for that exam subject. The exam performance will be scored on a consistent scale of 0-

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100 by each of the examiners, and the scores as well as the pass/fail decision for each area will be submitted to the graduate studies committee.

Process

This section outlines the process of petitioning for the examination, selection of topical areas, and determination of pass/fail.

Examination Announcement: Qualifying examinations and examination dates will be announced to all MAE graduate students by the MAE GSC at the beginning of each Fall and Spring semester. Students shall notify in writing the MAE Graduate office of their intent to take the examination during that semester (by September 15 in Fall and January 31 in Spring).

Choose Three Subjects: Students shall choose three subjects from the list of topics provided on page 4-5. The course numbers are representative of the subjects and the level of the questions to be expected. The goal of the examination is to test the students on their understanding of fundamental concepts.

- a. **Thermo-fluids students:** Shall choose two subjects from Heat Transfer, Fluids, and Thermodynamics. The third subject can be anything else from the subjects listed. Students may elect to choose all three subjects from the thermo-fluids group of questions.
- b. **Solid Mechanics students:** Shall choose two subjects from Mechanics, Dynamics, and Vibrations. The third subject can be anything else from the list of subjects. Solid mechanics students may elect to choose all three subjects from the solid mechanics group of questions.
- c. **Controls and Dynamical Systems students:** Shall choose two subjects from Controls, Dynamics, and Vibrations. The third subject can be anything else from the list of subjects. Controls and Dynamical Systems students may elect to choose all three subjects from the controls and dynamical systems group of questions.
- d. **Aerospace Students:**
 1. **Thermo-fluids students:** Shall choose two subjects from Aerodynamics, Fluids, and Heat Transfer. The third subject can be anything else from the list of subjects. Aerospace thermo-fluids students may elect to choose all three subjects from the aero-thermofluids group of questions.
 2. **Space Systems Students:** Shall choose two subjects from Space Systems, Controls, Aerospace Structures and Structural Dynamics. The third subject can be anything else from the list of subjects. Aerospace Space Systems students may elect to choose all three subjects from the space systems group of questions.

Take the Exam: The time and location for the qualifying exams will be arranged by the GSC and announced to all students who signed up for the exam.

Exam Results: Examining committee shall provide a pass or fail grade for each student who took the exam. These grades will be submitted within (**7 Days**) after the exam is administered. Assigning conditional grades is discouraged.

- a. **Pass at the first attempt:** If a student receives a passing score from the examiners on all three subjects, then the student is considered to have passed the exam, and the Graduate College will be notified to change his/her status as having passed the qualifying examination.

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- b. Pass at second attempt:** Students who did not pass one or more subjects on the first attempt may re-take the examination during the next offering of the qualifying exam. Students may re-take the failed subject (or subjects), or may select a new subject (or subjects). If the student passes the remaining subject(s) during the re-take, then student is considered to have passed the exam. Students will have two attempts to satisfy the qualifying exam requirements. The Graduate College will be notified, and his/her status as having passed the qualifying examination.

If a Ph.D. student does not pass the Qualifying Examination in two attempts the student may (i) switch to a M.S. degree program in MAE provided he/she has not earned an M.S. degree in MAE at UCF, (ii) switch to another department for a Ph.D. (requires a formal application to another department in the CECS and an admissions decision from that department), or (iii) appeal to the graduate studies committee (GSC).

Appeal

Only under exceptional circumstances would the GSC consider such an appeal. In consultation with the examining faculty and the department program area faculty, the GSC may require the student to take an oral examination in the failed subject or may recommend other remediation. Recommendation by the GSC in consultation with the examining faculty and the department program area faculty (Thermo-fluids, Mechanics, Mechanical Systems, and Aerospace) will be final.

MAE Ph.D. Qualifying Examination Subjects

Math:

Subjects: ODE's, PDE's, complex variables, transform methods, numerical methods, and linear algebra.
Sample courses: EML 3034 Modeling Methods in MMAE, EML 5060 Math methods in MMAE.

Heat Transfer:

Subjects: Conduction, convection and radiation heat transfer. Basic energy balances. Steady state and transient problems, analysis of simple heat exchangers. Radiation heat transfer in enclosures without and with participating media. Multi-mode heat transfer.
Sample courses: EML 4142 Heat Transfer I, EML 4143 Heat Transfer II, and EML 5152 Intermediate heat transfer.

Fluids:

Subjects: Principles of continuum fluid mechanics. Integral and differential forms of governing equations, fluid statics, dimensional analysis, measurements, internal flows, external flows, fluid machinery, 1D compressible flows.
Sample courses: EML 3701 Fluid Mechanics I, EML 4703 Fluid Mechanics II, and EML 5713 Intermediate Fluids.

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Thermodynamics:

Subjects: Work, heat, and energy transformations. Relation of properties. Thermodynamic Laws, concepts, and modes of analysis common to all applications of thermodynamics in engineering. Availability analysis, thermodynamics of reactive and non-reactive mixtures, thermodynamic cycle and design analysis of complete mechanical systems.

Sample courses: EGN 3343 Thermodynamics and EML 3101 Thermodynamics of Mechanical Systems.

Solid Mechanics:

Subjects: Concepts of stress, strain, strength, deflection of axial force members, shafts in torsion, beams in flexure, combined stress, stability of columns, and design of simple elements.

Sample courses: EGM 3601 Solid Mechanics, EML 3500 machine design, and EML 5237 Intermediate Mechanics of Materials.

Dynamics:

Subjects: Kinematics and kinetics of particles and rigid bodies; mass and acceleration, work and energy, impulse and momentum.

Sample courses: EML 3217 Engineering Mechanics - Dynamics, EML 4260 Dynamics of Machinery, and EML 5271 Intermediate Dynamics.

Vibrations:

Subjects: Undamped and damped vibration of single degree freedom systems. Forced vibration. Transient response. Multiple degree of freedom systems.

Sample courses: EML 4220 Vibration Analysis, EAS 4210 Space Structural Dynamics.

Controls:

Subjects: Mathematical modeling of dynamic systems: transient and steady state response; Root Locus and z-transform methods; discrete systems analysis; controller design.

Sample courses: EML 4312C Feedback Control, EML 4225 Introduction to Vibrations and Controls, and EML 4313 Intermediate System Dynamics and Controls.

Aerodynamics:

Subjects: Fundamental theories of inviscid, incompressible aerodynamics and flight mechanics, airfoil theory, external and internal flows, airplane performance. Viscous, incompressible fluid flow; flow over finite wings.

Sample courses: EAS 3101 Fundamentals of Aerodynamics, EAS 301, Fundamentals of Aerospace Flight, EAS 4105 Flight Mechanics, EAS 4134 High-Speed Aerodynamics.

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Aerospace Structures and Structural Dynamics:

Subjects: Aerospace structures and components, thin-walled open and closed section beams, structural idealization, fuselage and wing sections, structural instability (buckling). Fundamentals of vibration including degree of freedom systems, vibration control and measurement in aircraft and space applications.

Sample courses: EAS 4200 Analysis & Design of Aerospace Structures, and EAS 4210 Space Structural Dynamics.

Space Systems:

Two-body problem, orbital equations, orbital transfer, earth satellite operation. Physical and engineering aspects of space flights. Spacecraft propulsion and power. Issues in space environment. Communication with spacecraft. Space-borne instrumentation.

Sample courses: EAS 3530 Space Systems Concepts, EAS 4300 Aerothermodynamics of Propulsion, EAS 4505 Orbital mechanics.

Question Schedule

| <u>Day 1:</u> | <u>Day 2:</u> |
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| <u>Heat Transfer</u> (morning) | <u>Thermodynamics</u> (morning) |
| <u>Solid Mechanics</u> (morning) | <u>Aerodynamics</u> (morning) |
| <u>Vibrations</u> (afternoon) | <u>Dynamics</u> (morning) |
| <u>Space Systems</u> (afternoon) | <u>Math</u> (afternoon) |
| <u>Fluids</u> (afternoon) | <u>Controls</u> (afternoon) |
| | <u>Aerospace Structures and Structural Dynamics</u> (afternoon) |