

## I. INTRODUCTION

This handbook describes the policies and procedures for graduate studies in the Department of Aerospace and Mechanical Engineering of the University of Notre Dame. It emphasizes issues that are particular to the AME department. Additionally, it highlights some more general points that are detailed in other sources. The most important of these is the University of Notre Dame Graduate School's annual *Bulletin of Information*, which is the source of policies pertaining to all graduate students at the University. In addition there are some policies described in *Du Lac*, the University's student policy and procedure manual, which apply specifically to graduate students and are outlined in detail, such as leave of absence or withdrawal from the university. One additional source of information is the *Graduate and Professional Student Handbook* that is published yearly by the Graduate School as it provides details on student services, student life and student government. In particular students should review this document and be aware of the policies regarding discriminatory and sexual harassment as they will be serving in positions of teaching authority at times during their program. All students were provided a copy of this *Handbook* upon admission.

At the departmental level, all policy-making and administrative authority on graduate studies resides in the graduate studies committee, composed of the department chair, the director of graduate studies and elected department faculty members. The student's primary contact for all matters in graduate school is a faculty member who serves as the student's research advisor. Any policy question or administrative matter, which cannot be resolved by the student and advisor, should be referred in writing to the graduate studies committee via the director of graduate studies. During the 2003-04 academic year Dr. Thomas Corke will serve as the director of graduate studies during the Fall 2003 semester, and Dr. John Renaud will be the director of graduate studies beginning January 2004. Matters that cannot be resolved within the department can be appealed to the Graduate School, via the dean of the Graduate School.

These policies apply to all students enrolled during the 2003-2004 academic year. They are subject to change and may be different from policies published in previous years. An electronic version of this handbook is available at <http://www.nd.edu/~ame/gradHB.html>. More general information can be found at <http://www.nd.edu/~ame>. Nothing herein, in

previous handbooks or on-line is to be interpreted as contrary to the regulations of the Graduate School.

Topics covered in the body of this handbook are the basic responsibilities of graduate students, requirements for the M.S. and Ph.D. programs, and items related to selected facilities and services available in the department and University. Appendix A is the department's academic integrity policy. Each graduate student should read and be aware of both of this important policy. Appendix B lists faculty involved in the department's graduate program. Appendix C is a preliminary list of the graduate courses scheduled to be offered by the department during the 2003-2004 academic year. Students are advised to check the *Bulletin of Information* for a complete list of the AME courses along with a list of all graduate courses offered by other departments. For information on course content, students should consult the course instructor or the *Bulletin of Information*. Additionally, a complete schedule of course offerings, times, and locations is published each semester in the *Schedule of Courses*. Appendix D gives important dates in the academic-year calendar. Appendix E details the University sponsored travel policies as they apply to AME graduate students. Please note that all graduate students must submit a proposed travel form prior to making travel arrangements.

Often answers to questions regarding the graduate program can be found by contacting Ms. Nancy Davis in the AME department office, 365 Fitzpatrick. Ms. Davis is the department's administrative assistant responsible for the graduate program.

## II. BASIC RESPONSIBILITIES

Most full-time students receive a monthly stipend from the department. Funds for these stipends typically come from the externally funded grants and contracts of the student's advisor or from internal sources through the Graduate School. It is generally expected that full-time students receiving financial support from the University devote their professional time entirely to their research and course work within the University. Students are allowed the following University holidays: Thanksgiving and the following Friday, Christmas Eve through New Year's Day, Good Friday and Easter Monday, Memorial Day, and Independence Day. Students are expected to be present during Fall Break, Spring Break, and breaks before each semester and summer session. Any extra holiday time during periods in which the student is receiving financial support must be

approved by the student's advisor. Those students who are receiving financial support must receive approval from their advisor prior to pursuing any employment outside the Department.

Each year the student's overall graduate activities and progress towards their degree will be reviewed by the student's advisor in conjunction with the graduate studies committee. Continued financial support is dependent upon successful performance in research and course work as well as the availability of funds. While the department will endeavor to maintain or increase the stipend level, it cannot be guaranteed that the level of support will remain constant or increase with inflation. If funds are available, a student can expect an increase in stipend upon completion of the Ph.D. Candidacy Examination, described later in this handbook.

The most readily used means for assessment of the student's academic progress is through grades assigned in course work. The Graduate School grading system is on a four-point basis. Grades recorded for graduate courses are: A (4.0), A- (3.667), B+ (3.333), B (3.0), B- (2.667), C+ (2.333) and C (2.0) which is considered the lowest acceptable passing grade for graduate students, and F (0.0). The grades of C- and D are not awarded in the Graduate School. The department has adopted grade point average (GPA) standards that are higher than those required by the Graduate School. The department's standards are as follows: As described later, in order to take the Ph.D. Qualifying Examination, a prerequisite for admission to the Ph.D. program, a student must have a minimum GPA of 3.2 in those courses that satisfy degree requirements. A student whose cumulative GPA is below 3.0 or whose GPA in any given semester is below 2.5 may be subject to loss of financial support and/or dismissal.

Every student receiving a stipend is normally required to participate in the academic programs of the department by performing a teaching duty typically involving: 1) leading discussion or laboratory sections, 2) grading papers or examinations, or 3) tutoring. The purpose is to expose the student to some aspect of teaching-related activities for the mutual benefit of the graduate student and the academic program. During the first year, this responsibility will nominally require an average of eight hours per week; thereafter, it will require an average of four hours per week during the fall and spring semesters. First year students whose entire support comes from external sources (not internal fellowships) may be excused from this requirement in their first year of the graduate program. Students receiving stipend support as full or partial teaching

assistants will be expected to work up to 16 hours per week in direct support of the department's academic programs. During the last semester of a Ph.D. student's program, the semester in which they finish their dissertation, they can request to be designated as All-But-Dissertation (ABD) and will be relieved of this responsibility. A student will only be granted ABD status once during their program.

Students are required to participate in two of the mechanisms for public technical discussion offered by the Department. First, all students must enroll in AME 701, Graduate Seminar, every semester. The guidelines for participation in the Graduate Seminar are established by the department chairman and are distributed at the beginning of each semester. Secondly, all students are required to participate in the annual Graduate Student Research Conference usually held the Friday of fall break week. Students in their second year and beyond are required to make an approximately ten-minute presentation of their research at the conference.

The department supports a number of office complexes and individual research laboratories. Students are responsible for acquainting themselves with proper safety procedures and seeing that they are followed. Because the offices and laboratories are diverse in their purposes, procedures, and equipment, specific safety procedures will not be listed here. However, all users of these offices and laboratories are to observe the following safety and security procedures:

- a) Graduate students with a need for routine access into any of the laboratories may check out a key from the department office. Keys may not be traded among, loaned to, or passed on to other students and must be returned as soon as the need for routine access has passed.
- b) Users of a laboratory share in maintaining its security and orderly appearance. Laboratory doors are not to be propped open or left unlocked when the laboratory is unattended, and must be locked at the end of the working day. The equipment inside a laboratory is not, in general, insured against theft or damage.
- c) Unauthorized users are not allowed into a laboratory.
- d) Guests may be invited into a laboratory, but may not be left unsupervised. The host is responsible for the guests' safety.
- e) Each student using a laboratory must be acquainted with all the special safety procedures and safety equipment in the laboratory. These include the locations of

emergency controls (such as the shut-off switches) and the locations and use of all safety equipment and first aid supplies. It is essential that students not create hazards for themselves or their co-workers and that all laboratory personnel are able to take prompt, knowledgeable action if a hazardous situation does arise.

- f) Graduate students who supervise undergraduate laboratories assume primary responsibility for safety procedures. If additional safety supplies (such as hard hats or safety glasses) are required, the course instructor should be notified.
- g) Any graduate student developing a new experiment or acquiring new equipment will also be responsible for developing and recording the proper safety procedures.
- h) Any inadequacy of laboratory safety procedures or equipment must be reported immediately to a faculty member or the department chair so that the situation may be corrected.
- i) Repeated violations of safety procedures or the creation of unsafe or unhealthy conditions must be reported to the faculty and department chair. Repeated failure to work safely or to maintain orderly, professional working environments will result in the forfeiture of all office or laboratory privileges.

All graduate students must both register and enroll before each spring and fall semester to maintain student status; otherwise they have to apply for re-admission. The only exception is for officially approved leaves of absence. Students are required to register and enroll for the summer session *only* if they intend to graduate during that session, or if they wish to take a course offered in the summer session (the latter only with the consent of both their advisor and the department chair). However, all first-year students must register for GRED 501, which is offered only during the summer. (NOTE: All summer tuition must be applied for through the summer session office. Forms are distributed in late February and due back to the summer session office no later than March 31. Failure to apply may result in the student being charged and responsible for the cost of summer tuition.) For entering students, registration and enrollment is done two days prior to the beginning of classes. For continuing students, registration is in the middle of the prior semester, with the subsequent enrollment the day before classes begin. It is important for most students beyond the first year to register for research credit in AME 599 (M.S.) and 699

(Ph.D.). Students should consult the department's graduate administrative assistant as to how many hours of credit for which to register. Course selections should be made during registration after consultation with the advisor.

### III. DEGREED PROGRAMS

This section describes the Department's requirements for the M.S. (thesis), M.S. (non-research) and Ph.D. degrees. Additional details of University requirements, including residency and degree eligibility requirements, are in the *Bulletin of Information*.

A full-time graduate student is required to take 12 credit hours during the fall and spring semesters during each semester in residence. These 12 credits will most likely be a mix of course work and research credits. Once a student satisfies, or is registered in the appropriate courses that will satisfy, the course work and total credit requirements for the degree they are seeking, the student may take fewer than 12 hours and be designated as a full-time student.

One of the most important matters for graduate students is the choice of a faculty advisor. This choice can have a great effect on both the student's time in graduate school and long-term career path. Upon entry, graduate students are temporarily advised by their admission advisor or another faculty member assigned by the department chairman. Students are encouraged to speak with the faculty members in the area of their expressed interest in the first few weeks of their first semester. Students will be asked to submit a ranked list of potential advisors to the department chair by the end of the October. Based on this student input, the current faculty needs and available resources, the department chair will assign each student a faculty advisor. While final authority for the assignment of an advisor lies with the Department chair, in most cases individual students and faculty members make this arrangement without external intervention.

Introductory graduate-level courses are at the 500 level. Advanced graduate courses are at the 600 level. The department generally gives graduate credit only to 500 or 600 level courses within the Colleges of Engineering or Science. With the approval of the department chair, or the graduate studies committee chair, credit can be received for up to six hours of 400 level courses for both the M.S. (thesis) and the Ph.D. degree. Students completing the M.S. (non-research) degree can receive credit for up to nine hours of 400 level courses. Such credit will not be given for work that is considered remedial.

### A. Master's Degree (Thesis Option)

This section details the requirements for the M.S. (thesis) degree. A minimum of thirty credit hours must be taken of which up to six may be research credits (i.e. thesis direction credits). No foreign language examination is required. The department has established a single core course requirement that each M.S. (thesis) student must pass or have passed the equivalent at another institution. The graduate studies committee will judge whether or not courses at other institutions are equivalent. The core requirement is as follows:

#### MASTER'S PROGRAM (Thesis)

<b>1<sup>st</sup> Year</b>	<b>Fall</b>	<b>Courses: 9-12 hrs Research: 0-3 hrs</b>
	<b>Spring</b>	<b>Courses: 9-12 hrs Research: 0-3 hrs</b>
	<b>Summer</b>	<b>Research GRED501</b>
<b>2<sup>nd</sup> Year</b>	<b>Fall</b>	<b>(if req'd) Courses: 6 hrs Research: 6 hrs</b>

#### 1. Mathematical Methods I

Students must complete and pass one of the following mathematical methods courses in their first year of study:

- § AME 561 Mathematical Methods I (fall semester annually)
- Or
- § CHEG 542 Mathematical Methods in Engineering I (fall semester annually)

Both courses are foundational for graduate studies in engineering with AME 561 being a more advanced course.

To be admitted to Candidacy for the M.S. (thesis) degree, the student must apply for admission by submitting the appropriate form to the Graduate School through the department chair. This should be done in the semester in which the thesis is written.

All full-time M.S. (thesis) students must write a thesis that is generally completed during the third or fourth semesters. The student's advisor signs the thesis to indicate final approval and its readiness for readers appointed by the graduate studies

committee. The candidate then delivers copies of the thesis to the readers. To be accepted, the thesis must be approved by at least two readers. The advisor may not be one of the official readers. The readers report their decision on the appropriate form to the Graduate School. The final version of the thesis must conform to the requirements as outlined on the Graduate School's web page, <http://www.nd.edu/~gradsch/currentstudent/DissGuide/DissGuide.html>. All theses *must* be checked for format conformity by the Graduate School before final submission (see Shari Hill in the Graduate School). After passage of an oral examination, described in the next paragraph, the definitive copy, which has been approved by the readers, must be submitted to the Graduate School. Once the thesis is approved by the Graduate School, the student is required to make four additional copies. These four and the original must be submitted to the Hesburgh Library (Rm. 221) for binding. Two of these copies remain with the Library, and the other three will be returned to the department. One of those returned will be given to the advisor, one will remain on file with the department, and the third is the student's copy. The student is responsible for the cost of all of copies and binding, including any additional copies for the readers.

The final comprehensive examination for the M.S. (thesis) degree is an oral examination and covering the area of the thesis. It is scheduled upon the request of the student, but will not be given less than one week from the time that the completed thesis is made available to the examining committee. This committee will consist of a minimum of three faculty members, normally the thesis advisor plus the two readers.

The examination begins with a presentation, open to the public, of thirty to forty minutes by the candidate. The presentation should review the major elements of the thesis and should be primarily directed to the thesis readers. After the presentation, the thesis advisor calls for questions from members of the committee as well as the general audience. Additional questioning by the committee may be conducted in private upon excusing the public audience. After the examination, the thesis advisor may excuse the candidate and call for discussion followed by a vote of committee members. A candidate passes upon either the unanimous consent or the consent of all except one member.

### B. Master's Degree (Non-thesis Option)

This section gives the specific requirements for the M.S. (non-research) degree. The M.S. (non-

research) degree is generally not an option for students receiving financial support from the department. Students receiving financial support from the department must obtain the approval of their advisor and the department chair prior to matriculating in the M.S. (non-research) program. A total of at least thirty credit hours of course work must be taken. Of these, up to six credit hours may be taken as directed studies (i.e. AME 598 credits) under the direction of your advisor. The M.S. (non-research) degree has no core course requirements and no foreign language examination is required.

To be admitted to Candidacy for the M.S. (non-research) degree, the student must apply for admission by submitting the appropriate form to the Graduate School through the department chair. This should be done in the semester in which the final M.S. (non-research) oral examination is scheduled.

The final comprehensive examination for the M.S. (non-research) degree is an oral examination by a committee of department faculty. It is scheduled upon the request of the student, but will not be given less than one week from the time that the student notifies the examining committee. This committee will consist of a minimum of three faculty members, normally the faculty advisor plus the two other faculty members.

The examination begins with a presentation of thirty to forty minutes by the candidate. The presentation topic/focus will be decided upon by the student and their advisor. After the presentation, the faculty advisor calls for questions from members of the committee. After the examination, the faculty advisor may excuse the candidate and call for discussion followed by a vote of committee members. A candidate passes upon either the unanimous consent or the consent of all except one member.

### **C. Master of Engineering in Mechanical Engineering**

This degree is offered as a special program by the department and details on the program are provided by the director of the MEME program.

### **D. Doctoral Degree**

This section describes the requirements for the doctoral degree. It is assumed in the following that the student enters with a B.S. degree. Requirements for those who already have a M.S. degree are given in a separate section. The M.S. degree is not a prerequisite for the Ph.D. program.

A minimum of eighteen credit hours of course work is required in the first year, excluding

research credits for students receiving support from University sources. First year students supported in full by external funding can take fewer course credits, and more research credits, with the approval of their research advisor, though care should be taken that they are still prepared to take the qualifying examination described below. Students should meet with their temporary advisor at the beginning of their first semester to prepare an individual course of study for the first semester. A permanent research advisor should normally be assigned by the end of the first semester and that advisor will then work with the student to plan the remainder of their program.

The department has established a group of core course requirements that each Ph.D. student must complete and pass or have passed the equivalent of at another institution. The graduate studies committee will judge whether or not courses at other institutions are equivalent.

The core course requirements are as follows:

#### **1. Mathematical Methods I**

Students must complete and pass one of the following mathematical methods courses in their first year of study:

- AME 561 Mathematical Methods I (fall semester annually)
- or
- CHEG 542 Mathematical Methods in Engineering I (fall semester annually)

Both courses are foundational for graduate studies in engineering with AME 561 being a more advanced course. Students entering the program with a M.S. degree or equivalent advanced studies in mathematical methods are strongly advised to take AME 561. The AME Ph.D. qualifying exam in applied mathematics will be based on the material presented in these courses.

#### **2. Mathematical Methods Elective**

Students must complete and pass a second 3-credit course in mathematics by the end of their second year of study. Students whose studies are concentrated in the aerodynamics, heat transfer or fluid mechanics field are advised to complete AME 562 in their second semester of study. Students in other research areas should consult with their advisor to determine the most appropriate course for their field of study. Candidate courses that satisfy the mathematics elective requirement include:

- § AME 562 Mathematical Methods II (spring semester annually).
- § 500 or 600 level courses in the Department of Mathematics; requires approval of the graduate studies committee.
- § 500 or 600 level applied mathematics courses in the College of Engineering; requires approval of the graduate studies committee.

### **3. Numerical Methods**

Students must complete and pass a 3-credit course in numerical methods by the end of their second year of study. Candidate courses that satisfy the numerical methods elective requirement include:

- § CSE 513 Numerical Methods and Computation - Large-scale linear systems
- § AME 521 Numerical Methods --- ODE and PDE techniques
- § CE/AME 563 Finite Elements in Engineering - -- Finite-Elements course
- § If a student wishes to take another course to satisfy this core requirement, they should submit a request in writing to the graduate studies committee prior to taking the course.

*Note: AME 570 Advanced Measurements Laboratory was a core course for the AME Ph.D. program prior to the 2000-2001 academic year. This course is no longer required as a core course in the AME Ph.D. program.*

#### *Course Requirements*

Students are expected to complete all degree requirements in approximately four years. The student must complete a minimum of thirty-nine course credit hours, which include nine hours from the core courses and eighteen hours in a focus area defined by the advisor and student. At least nine of these credits should be in an area different from the student's specific area of research, and at least six should be outside the department. In addition, the student should take any other courses deemed necessary by their advisor or Candidacy Examination committee. There is no foreign language requirement. A total of seventy-two semester credit hours (including both course credits and research credits) are required for the Ph.D. degree.

#### *Ph.D. Qualifying Examination*

The Ph.D. Qualifying Examination is a written examination whose purpose is to determine whether the student should be admitted to the

Ph.D. program. This examination is given once a year at the end of the spring semester. In order to enter the Ph.D. Program, students are required to take this examination after two semesters, or after three semesters if they initially enrolled in the spring. The summer term is not counted for this purpose. Under special circumstances a student can petition to take the Qualifying Examination at the end of their second year of studies.

In order to be eligible to take this examination, the student must have a minimum GPA of 3.2. Students who do not meet the GPA requirement at the time when they are scheduled to take the Qualifying Examination are ineligible for the Ph.D. program.

The examination is given over a three-week period (one day per week for three weeks) and this period usually begins the week after the Spring Commencement. The Qualifier consists of examinations in three areas: 1) Mathematical Methods, 2) the student's Major Area, and 3) any other area outside of the major area and selected by the student.

The purpose of the exam is to determine a student's proficiency in the selected topics at a level consistent with that generally covered in the first-year graduate courses. As indicated above, each student will select two topic areas in addition to the required topic, Mathematical Methods. One of the additional topics must be associated with a "core course" in their major area of specialization. Currently the five specialization areas in the department are Fluid Mechanics and Heat Transfer; Design and Manufacturing, Control and Robotics, Solid Mechanics and Materials, and Bioengineering. The third topic area can be any of those that are included in the following list. This list is based upon courses that are planned to be offered during the 2003-2004 academic year.

#### 1.) Mathematical Methods:

This examination is based upon materials presented in the graduate level mathematics courses that satisfy the core course requirements for the Ph.D. degree; AME561 Mathematical Methods I or CHEG542, Mathematical Methods in Engineering I.

#### 2.) One "core course" in major area of specialization:

**AME 538 Intermediate Fluid Mechanics (Core material for Fluid Dynamics and Heat Transfer -fall semester only)**

AME 544 Optimum Design of Mechanical Elements (**Core material for Design/Manufacturing - spring semester only**)

AME 550 Advanced Control Systems (**Core material for Controls/Robotics - fall semester only**)

AME 559 Advanced Mechanics of Solids (**Core material for Solid Mechanics /Materials - fall semester only**)

AME 598 Biomechanics (**Core material for Bioengineering -fall semester only**)

3) One additional topical area based upon one of the following courses:

AME 541 Advanced Kinematics

AME542 Mechanical Behavior of Materials

AME 545 Intermediate Heat Transfer

AME 551 Advanced Vehicle Dynamics

AME 553 Acoustics

AME 555 Analytical Dynamics

AME 558 Elasticity

AME 598 Advanced Aerodynamics

The 3<sup>rd</sup> examination topic can also be one of the other specialization topics outside of the students "core" area.

Students will be required to designate the two discipline areas in which they want to be tested by April 15, 2004. There will be 2-4 problems given in each topic area. Each test session, covering one topic area, will last two hours.

The exam given during the first week will be on Mathematical Methods. The order of exam topics given on the remaining two weeks will be determined based on the total number selected, and will be scheduled to insure that a student is tested in only one area per week.

It is strongly recommended that students choose their courses carefully in the first year in order to have adequate preparation for the Qualifying Examination. Students entering the Ph.D. program with B.S. degrees should plan to take the core course in their major area of specialization and another of the 500 level courses listed above. Students entering with M.S. degrees should review

the course descriptions for AME 561(Mathematical Methods I) and the core course in their major area of specialization to ensure that they have the necessary background to be prepared for these examinations. If there is a doubt that they have the proper background, the student should consider any number of alternatives including: auditing the course, or a self-review using the same or a similar textbook used in the course. Students entering with M.S. degrees who have taken equivalent 500 level courses that they plan to apply to their Ph.D. program, cannot take them again for credit but should take similar actions to make sure they are prepared for the appropriate Qualifying examinations.

Students and their advisors will be notified of the outcome of the exam within three weeks of the completion of the exam. Students who fail the exam on the first attempt, can petition (in writing) the graduate committee to re-take the exam the following year.

#### *Admission to the Doctoral Program*

To assist in the overall evaluation of the student the research advisor will also be asked to provide the graduate studies committee with a written recommendation concerning the student's suitability for admission to the doctoral program. This written recommendation should be submitted prior to the beginning of the Qualifying examinations.

The graduate studies committee will then make a decision on the admission of the student into the doctoral program after reviewing the student's academic record, the Qualifying examination results and the recommendation of the research advisor.

Admission to the degree program does not in itself constitute admission to degree candidacy for which additional requirements are described below.

#### *Ph.D. Candidacy Examination*

The Ph.D. Candidacy Examination should normally be successfully completed prior to the fifth semester of residence, and after the student has successfully completed at least thirty credits of course work. The examination is administered by the Candidacy committee, which consists of 1) the student's advisor(s), 2) at least three other faculty members, who will also serve as dissertation readers, selected by the student with the approval of the advisor(s), the graduate studies committee, and the Graduate School, and 3) a non-voting chair who is appointed by the Graduate School. To initiate the Candidacy process, the student should

consult with their advisor(s) to select members of a Candidacy committee. The student then obtains a form from the department and completes it with the names of the committee members. Care should be exercised in the selection of the voting members, as they, along with the advisor(s), will also serve as the voting members in the Ph.D. Dissertation Defense. A candidate must petition the graduate studies committee for any change in the composition of the committee after passage of the Candidacy Examination. Only in extraordinary circumstances will the graduate studies committee approve a change. Examples of circumstances under which a change would likely be approved include serious illness or permanent departure from the University of a committee member and it should be emphasized that final approval of a change can only come from the Graduate School. Addition of a member will likely be approved if it is demonstrated that the new member brings relevant expertise to the committee. An extended sabbatical leave by a member of the committee will only be accepted as a need for a change if evidence is given that an acceptable communication link cannot be established for the examination to take place. If a student wishes to include someone from outside of the University on their committee, they should see the graduate program administrative assistant, as this requires a special process and approval from the Graduate School.

The Candidacy Examination itself consists of a written part followed by an oral. It is the student's responsibility to schedule both. The oral examination is scheduled only after passage of the written. The Graduate School requires notification 10 business days, excluding holidays, prior to the scheduled oral examination date in order to appoint an outside chair. However, if the student and advisor wish to find their own outside chairman, this time can be reduced to 5 business days, excluding holidays.

The purpose of the written examination is to verify the student's capability of conducting Ph.D. level research within his or her area of specialization. The format of the written part will be decided by each member of the student's committee and typically takes the form of a problem, project or a review of the student's written candidacy proposal or other research publications. Each member of the committee will report the results (i.e. pass or fail) of their portion of the examination on a Written PhD Candidacy Examination verification form, which can be obtained through the graduate administrative assistant. Only when this form has been signed by all the committee members and returned to the

department can the Graduate School be requested to schedule the oral part of the examination.

The oral examination explores the feasibility, originality, and significance of the proposed Ph.D. dissertation topic. The oral examination will cover material in the written dissertation proposal and can include questions which are generally relevant to the student's area of research but which are not specifically related to the dissertation proposal. This proposal should be submitted to each member of the Candidacy Examination committee at least two weeks prior to the oral examination. Typically the dissertation proposal consists of about twenty pages of text, wherein the dissertation topic, plan of research, and significance of expected original contributions of the research are summarized.

Both portions of the Candidacy Examination are passed or failed by a vote of the Candidacy Examination committee. To pass, the student must receive the support either of all members or all members except one. In the case of a failure, the student may be allowed up to one re-examination by the department chair upon recommendation of a majority of the Candidacy Examination committee members and the approval of the Graduate School. A doctoral student who has successfully completed all parts of the doctoral Candidacy Examination may receive a non-thesis Master's degree upon the student's request and the recommendation of the student's advisor, the director of graduate studies, and the department chair.

#### *Students with M.S. Degree*

There are some modifications which apply only to those students with either an M.S. degree from another University or who hold an M.S. degree from Notre Dame but who are coming back after an absence from the University. In such cases, a request to the graduate studies committee for transfer of up to 24 credits from a master's degree obtained within a period no longer than five years prior to admission to Notre Dame may be made. To receive credit for a graduate course taken elsewhere, the course grade will need to be a B or better. The graduate studies committee will make a determination if any of these credits can additionally satisfy the requirement that at least two courses must be taken outside of the department. A maximum of 6 hours of graduate course credit may be accepted from the graduate courses completed elsewhere if no graduate degree was earned. The Qualifying Examination should be taken at the earliest opportunity, and the Candidacy Examination prior to the fifth semester; however, students must take and pass their candidacy exam no later than their 8<sup>th</sup> semester or

they forfeit their academic and financial eligibility. It is expected that the student will finish the requirements for the Ph.D. in approximately three years.

## DOCTORAL PROGRAM

### Preparation of Dissertation

After the completion of research, the student will prepare a written dissertation. The final version of the thesis must conform to the requirements as outlined on the Graduate School's webpage: <http://www.nd.edu/~gradsch/currentstudent/DissGuide/DissGuide.html>. All theses *must* be checked for format conformity by the Graduate School before its final submission (see Shari Hill in the Graduate School). When the dissertation advisor(s) is/are satisfied that the dissertation is in suitable form, the advisor(s) will sign a distribution form, available from the department, releasing the dissertation for distribution to the three or more official dissertation readers. The Ph.D. candidate will deliver this signed form along with the required copies of the dissertation to the department graduate studies administrative assistant who will distribute the dissertation and the Ph.D. reader's card to the readers.

The dissertation defense may not be scheduled sooner than six weeks from the date the graduate studies administrative assistant receives the dissertation distribution form and copies of the dissertation. It is expected that during this time each reader will carefully read the dissertation then meet individually with the candidate and discuss suggested or necessary changes to be made before the oral defense. The oral examination will not be scheduled until all the Ph.D. reader's cards have been signed and returned to the graduate studies administrative assistant. It is expected that all readers will have met with the candidate at least two weeks prior to the scheduled date of the oral defense and have reported their approval or disapproval at least one week prior to the scheduled date of oral defense. Only a dissertation unanimously and unconditionally approved by the three readers may be defended.

After the oral defense and approval by the Graduate School, the student is required to make four additional copies. These four and the original must be submitted to the Hesburgh Library (Rm. 221) for binding. Two of these copies will remain with the Library, and the other three will be returned to the department. One of those returned will be given to the advisor, one will remain on file in the department, and the third is the student's copy. The student is responsible for the cost of all

copies and binding, including any additional copies for the readers.

## DOCTORAL PROGRAM

		<i>Students entering with B.S.</i>	<i>Students entering with M.S.*</i>
1 s t u d e n t Y e a r	F a l l	Courses: 9 hrs Research: 3 hrs	Courses: 6 hrs Research: 6 hrs
	S p r	Courses: 9 hrs Research: 3 hrs QUALIFYING EXAM	Courses: 6 hrs Research: 6 hrs QUALIFYING EXAM
	S m r	Research GRED 501	Research GRED 501
2 n d Y e a r	F a l l	Courses: 6 hrs Research: 6 hours	Courses: 3 hrs Research: 9 hours
	S p r	Courses: 6 hrs Research: 6 hrs CANDIDACY	Research: 10 hrs CANDIDACY
	S m r	Research	Research
3 r d Y e a r	F a l l	Courses: 6 hrs Research: 6 hrs	Research: 1 hr
	S p r	Courses: 3 hrs Research: 9 hrs	Research: 1 hr
	S m r	Research	Research Ph.D. DEFENSE
4 - 5 t h Y e a r	F a l l	Research: 3 hrs	
	S p r	Research: 3 hrs	
	S m r	Research Ph.D. DEFENSE	*assuming 24 credits transferred

### Defense of Dissertation

The purpose of the Ph.D. Dissertation Defense is to explore the originality and significance of the candidate's dissertation. The defense examination

committee includes at least the three official readers, the research advisor, and a non-voting chair appointed by the Graduate School. It is the candidate's responsibility to determine a mutually agreeable time for the defense. The scheduled date and time, accompanied with the readers' cards, are returned to the Graduate School at least 10 business days, excluding holidays, prior to the defense of the dissertation. The Graduate School then selects the committee chair from an outside department. The defense is open to the public; fellow graduate students are encouraged to attend. The candidate should post the time and place one week in advance of the defense. The candidate should reserve a room for the defense and provide necessary audio-visual equipment; assistance in the scheduling matters can be obtained from the department's secretarial staff.

The examination begins with a summary presentation of thirty to forty minutes by the candidate. The presentation should review the major elements of the dissertation and should be directed primarily to the dissertation readers. After the presentation, the chair calls for questions from members of the committee as well as the general audience. Additional questioning by the committee may be conducted in private upon excusing the public audience. After the examination is completed, the chair may excuse the candidate and call for discussion followed by a vote of committee members. A candidate passes upon either the unanimous consent or the consent of all except one member. The chair sends a written report of the examination's overall quality and of the voting results to the Graduate School.

Failure of the defense does not necessarily require rewriting the dissertation, but does require a second defense. Failure in the second defense terminates the candidate's eligibility for a doctorate at the University.

## **IV. FACILITIES AND SERVICES**

### **A. Library**

The University Library system consists of a series of libraries. Computerized catalog systems can be accessed from terminals in the main or branch libraries as well as from any terminal on the campus network. Circulation policies and operating hours are available at the libraries. Students should make themselves aware of these resources the libraries provide and become more familiar with them by visiting the library web site, [www.nd.edu/~ndlibs](http://www.nd.edu/~ndlibs).

### **B. Computing Facilities**

The Office of Information Technologies (OIT) oversees an extensive variety of mainframe computers, workstation clusters, and personal computer facilities throughout campus. Many are open year-round, twenty-four hours a day. The University is fully networked and has a large amount of software and printing services available for the use of all students. For a complete current listing of University facilities, which change often, students should visit their web page located at <http://www.nd.edu/~ndoit>.

The department maintains a number of computers and printers for research calculations, data acquisition, and report preparation. Please see you advisor to determine what resources will be available for you use.

### **C. Laboratory Facilities**

A large variety of research and instructional laboratories exist in the department. These are located primarily on the third floor of Fitzpatrick Hall and Cushing Hall, throughout the basement of Fitzpatrick Hall, and in the Hessert Laboratory for Aerospace Research.

### **D. Office Facilities**

All full-time graduate students have twenty-four hour access to personal office space in Cushing Hall, Fitzpatrick Hall, or the Hessert Laboratory. Offices are typically shared with other students. Most are air-conditioned and have phones for local calls. Each student will also have a mailbox located in or near the main office in Fitzpatrick Hall or the Hessert Laboratory. As much as possible, it is encouraged for students to use their office as a base for carrying out day-to-day academic activities. Students are expected to maintain professional office environments and if this is not the case, based upon the decision of the department chair, a student may lose the opportunity to have an on-campus office.

### **E. Copying Facilities**

There are a number of copying facilities on campus, with services available at a charge. Many small machines are located in Hesburgh Library and each branch library. For more specialized services, students can go to 1) the Library Copy Service Center located in 214 Hesburgh Library; 2) the Engineering Copy Center located in Room 257 Fitzpatrick Hall, or 4) the commercial copy shop

located in LaFortune Hall. The departmental copy machines are *not* available for the use of students.

#### **F. Student Government Service**

Graduate students operate the Graduate Student Union (GSU). Through a council of elected officers, appointed officers, and representatives from the departments of its constituent colleges, the GSU provides a variety of services and represents its membership on various University councils and committees. It publishes the bimonthly GSU newsletter, conducts a graduate orientation program, and sponsors workshops, travel grants, and various social and cultural activities. The GSU is the graduate students' official liaison with University administration, the Office of Student Activities, and the Library Administration. The GSU finances operations through a yearly fee assessed on all graduate students. The GSU maintains offices in 219 LaFortune Student Center, 631-6963.

#### **G. Health, Counseling, Career and Placement, International, and Religious Services**

There are many additional services available to graduate students. Most are described in detail in the *Bulletin of Information*.

University Health Services, located in the University Health Center, 631-7497, provides immediate, follow-up, and ongoing health care. The services provided include outpatient clinics, dispensing medication, administering allergy injections, laboratory and x-ray facilities, and a twenty-five-bed inpatient unit. Health insurance is required of all international and full-time students. The University offers a plan for all students. The student's spouse and children have the option of purchasing health insurance through this plan. More information can be obtained by calling 631-6114. The University Counseling Center, located in the University Health Center, 631-7336, offers professional services to all graduate students and their families.

The University offers a Career and Placement Service, Hesburgh Library Lower Level, 631-5200, to assist in post-graduate placement. The University supports an International Student Affairs Office, 205 LaFortune, 631-5243, which aids in immigration matters, serves as liaison with sponsoring agencies and governments, and promotes interaction within the University. The International Student Organization (ISO), 204 LaFortune, is a club for interested students. The University has several excellent athletic facilities, most of which are available free of charge.

Campus Ministry, 103 Hesburgh Library, 631-7800, offers many programs to serve students' spiritual needs. In keeping with the character of the University, most programs are oriented with the Catholic faith; students of other religious traditions are welcome to any of the services provided.

## APPENDIX A. ACADEMIC INTEGRITY

In questions involving academic integrity the student is referred to the general policy found in the Graduate School *Bulletin of Information*.

The department expects all students to maintain and promote the highest standards of personal honesty and professional integrity. These standards apply to examinations, assigned papers, projects and preparation of the thesis or dissertation. Violation of these standards, which includes, but is not limited to cheating in examinations, plagiarism and fraudulent practices in conducting research or reporting the results of such research, may result in suspension or dismissal.

Within the department, primary authority for judgment and decision on matters of academic integrity lies with the course instructor for issues, which arise in the classroom, or the faculty research advisor for issues that arise in research. Unsettled disputes should be referred first to the director of graduate studies and next to the department chair each of whom can serve as arbiters at the department level. Any further appeal should be directed to the Graduate School.

**APPENDIX B**  
**AEROSPACE AND MECHANICAL ENGINEERING GRADUATE FACULTY**

Faculty Member	Doctoral Institution	Year of Ph.D. Graduation	Research Area	Administrative Assignment
<i>Professors</i>				
Hafiz M. Atassi	Paris	1966	Fluid Mechanics	
Stephen M. Batill	Notre Dame	1972	Design	Department chairman
Thomas C. Corke	Illinois Inst. Tech.	1981	Fluid Mechanics	Graduate Studies Committee Director of Grad Studies, Fall 2003
Patrick F. Dunn	Purdue	1974	Fluid Mechanics	
Frank P. Incropera	Stanford	1966	Heat Transfer	Dean, College of Engineering
Eric J. Jumper	Air Force Inst. Tech.	1975	Aerodynamics	Graduate Studies Committee
Thomas J. Mueller	Illinois	1961	Aerodynamics	
Robert C. Nelson	Penn State	1974	Flight Mechanics	
Samuel Paolucci	Cornell	1979	Fluid Mechanics	
Timothy Ovaert	Northwestern	1989	Tribology	
John E. Renaud	Rensselaer	1992	Design Automation	(On leave Fall `03) Director of Grad Studies beginning January 2004
Mihir Sen	M.I.T.	1975	Heat Transfer	
Steven B. Skaar	Virginia Tech.	1982	Dynamics	
Flint O. Thomas	Purdue	1983	Fluid Mechanics	
<i>Associate Professors</i>				
Edmundo Corona	Texas	1990	Solid Mechanics	
Robert A. Howland, Jr.	N.C. State	1974	Dynamics	
John W. Lucey	M.I.T.	1965	Nuclear Engineering	
James J. Mason	Cal. Tech.	1993	Solid Mechanics	(On leave `03-`04)
Joseph M. Powers	Illinois	1988	Combustion	
Steven R. Schmid	Northwestern	1993	Tribology	
Michael M. Stanisic	Purdue	1986	Machine Kinematics	
<i>Assistant Professors</i>				
Alan P. Bowling	Stanford	1998	Robotics	
J. William Goodwine	Cal Tech	1998	Robotics	Graduate Studies Committee
Glen L. Niebur	Univ. California	2000	Biomechanics	
Scott C. Morris	Michigan State	2002	Aero Fluids	
Ryan K. Roeder	Purdue	1999	Materials	Graduate Studies Committee

**APPENDIX C**  
**GRADUATE COURSES OFFERED-AEROSPACE AND MECHANICAL ENGINEERING**  
*2003-2004 Academic Year*

Course	Title	Instructor	Semester Offered
AME 521	Numerical Methods	Powers	Fall 2003
AME 538	Intermediate Fluid Mechanics	Dunn	Fall 2003
AME 542	Adv. Mech. Behavior of Materials	Roeder	Fall 2003
AME 550	Advanced Control Systems	Skaar	Fall 2003
AME 553	Acoustics	Atassi	Fall 2003
AME 559	Advanced Mechanics of Solids	Corona	Fall 2003
AME 561	Mathematical Methods I	Morris	Fall 2003
AME 570	Advanced Measurements Lab	Corke	Fall 2003
AME 598I	Intelligent Systems	Sen	Fall 2003
AME 598F	Orthopaedic Biomechanics	Niebur	Fall 2003
AME 598J	Manipulator Design	Stanisic	Fall 2003
AME 604	Hydrodynamic Stability	Thomas	Fall 2003
AME 654	Nonlinear Controls	Goodwine	Fall 2003
AME 698H	Metal Forming	Schmid	Fall 2003
AME 698I	Integral Transform Methods	Paolucci	Fall 2003
AME 541	Advanced Kinematics	Stanisic	Spring 2004
AME 544	Optimum Design	Renaud	Spring 2004
AME 545	Intermediate Heat Transfer	Sen	Spring 2004
AME 551	Advanced Vehicle Dynamics	Nelson	Spring 2004
AME 555	Analytical Dynamics	Skaar	Spring 2004
AME 558	Elasticity	Corona	Spring 2004
AME 562	Mathematical Methods II	Chang (CBM)	Spring 2004
AME 598*	Advanced Aerodynamics	Mueller	Spring 2004
AME 601	Viscous Flow	Powers	Spring 2004
AME 623	Thermal Convection	Sen	Spring 2004
AME 657	Continuum Mechanics	Ovaert	Spring 2004

**APPENDIX D**  
UNIVERSITY OF NOTRE DAME  
ACADEMIC YEAR CALENDAR FOR 2003-2004

View online at <http://www.nd.edu/~gradsch/currentstudent/currentstudentmenu.html>

**APPENDIX E**  
GUIDELINES FOR UNIVERSITY SPONSORED TRAVEL

Policy online at [http://www.nd.edu/~control/AP/travel\\_bro3.pdf](http://www.nd.edu/~control/AP/travel_bro3.pdf)