

Graduate Student Handbook

Ph.D. Program in Mechanical Engineering

**DEPARTMENT OF MECHANICAL AND AEROSPACE
ENGINEERING**

The University of Texas at Arlington

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WELCOME!

The faculty, staff and students in the Mechanical Engineering Program would like to welcome you to the doctoral program in Mechanical Engineering. This handbook is designed to help you get acquainted with the workings of our program. The information in this handbook will let you know what needs to be done, when it needs to be done, where you need to go to get information, and who can help you with problems that may occur. This handbook, the UTA Student Handbook, the Graduate Catalog (www.uta.edu/gradcatalog/mechanical_engineering), and the MAE Department website (www-mae.uta.edu) will serve as sources of information for you as you progress through our program.

NAMES YOU SHOULD KNOW

Graduate Advisor Professor Albert Tong
206A Woolf Hall
817-272-2297
tong@uta.edu

Most of the decisions you make concerning your academic program will be made with the assistance of the graduate advisor. This includes curriculum, registration, adding and dropping courses, and completing the necessary paperwork as you pursue your degree. The graduate advisor is your first point of contact for all of these matters.

Associate Chair for Mechanical Engineering Dr. S. M. You
202 Woolf Hall
817-272-2561
you@uta.edu

The Associate Chair is responsible for all decisions concerning the operations of the program, including the funding of all teaching and research assistantships as well as scholarships.

Chairman, Committee on Graduate Studies Professor Kent Lawrence
300 D Woolf Hall
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lawrence@uta.edu

Many decisions concerning the requirements of the graduate program are made by the ME Committee on Graduate Studies. This committee also handles student petitions and reviews the progress of all students in the program periodically.

Program Senior Office Assistant Debi Barton
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dbarton@uta.edu

GETTING STARTED IN THE PROGRAM

Department Check-in

Upon arrival at the university, please come to the departmental office in Room 204 Woolf Hall. A ME staff assistant will assist you in getting started at UT Arlington.

Orientation for International Students

All international students must attend a university orientation for foreign students, most often given a week or two before school starts. You will receive a letter directly from the International Office regarding this orientation. This orientation is required before you can be advised and register for classes.

Students Requiring GESP

Those students who were admitted to the ME Program with an English deficiency must go to the GESP Office and be tested prior to meeting with the ME Graduate Advisor. The ME Graduate Advisor will not advise such students until the GESP Office has provided the ME Graduate Advisor with the results of the GESP tests.

Meeting with the ME Graduate Advisor

When you check in with the ME staff assistant, you will be provided information for meeting with the ME Graduate Advisor for the purpose of being advised for course selection for your first semester. Prior to meeting with the ME Graduate Advisor, please review this handbook, the semester ME course offerings, the ME section of the Graduate Catalog, and the MAE Department website, and have a plan for which courses you wish to take. (The current semester's schedule of classes gives the exact days and times for registration and should be consulted each semester, not only for registration information, but for advising instructions, as well. The spring schedule is available in mid-October; the summer/fall schedule is available in mid-March.) Subsequently, you will meet with the ME Graduate Advisor, who will approve your plan and clear you to register. Once a student has passed 9 hours of coursework and achieved at least a 3.0 GPA, the student will not have to meet with the ME Graduate Advisor for the purpose of being advised for courses and clearance for registering.

Registering and Obtaining UTA Identification (ID) Card

Once you have met with the ME Graduate Advisor, you may register for courses on the UT Arlington website, www.uta.edu/mymav. In order to attend any given semester, a student must register and pay fees. As a part of enrolling in the university, you will be required to obtain a MAV EXPRESS card from the Mav Express Office, Main Level of the University Center. This card will allow you access to various campus events, the library, and the health center, as well as being a source of identification to verify that you are a UT Arlington student.

Graduate Teaching and Research Assistants

U.S. Students

U.S. students must attend an orientation session for all new employees. You will need to bring your social security card and your Texas driver's license or some other I.D. This session is mandatory, and you will not get paid unless you attend. The session takes about one and one half hours to complete.

International Students

You will first need to go to the International Office with your visa to obtain an Identity and Employment Authorization letter. This letter certifies that you have a visa and that you are allowed to work in the U.S. You must take this letter to the Office of Human Resources (J.D. Wetsel Service Bldg. (corner of Mitchell & Davis Streets) along with your passport and social security card (if you have one) to set up an orientation session given to all new employees. This session is mandatory, and you will not get paid unless you attend. This session takes about one hour. If you do not have a social security card, you must return to personnel after you receive your card and show it to them. All students that will be paid in any way must have a social security number. Most international students will have to apply for a card and this should be done as soon as possible. Applications must be delivered in person to the Tarrant County Court House in Fort Worth (819 Taylor Street) or to the Arlington office of the Social Security Administration. At the international student orientation session held by the International Office, you can fill out an application for a social security number and that office may arrange to take students to Fort Worth to submit the form. If you are unable to go at that time, you can go any time on your own. It takes about two weeks to get your card, but you can call, after several days, and receive your number only; you cannot be paid until you get your social security number.

English Proficiency. Before being appointed to a teaching assistantship at UT Arlington, a student whose native language is not English must demonstrate English proficiency. The preferred method to demonstrate proficiency is by submitting an acceptable score of 45 or higher on the Test of Spoken English (TSE) or by earning a score of 23 on the Speaking Section of the TOEFL iBT, or by earning a score of 7 on the Speaking Section of the IELTS. Holding a degree(s) from a U.S. college or university does not exempt from this requirement assistantship applicants who are non-native speakers of English.

Developmental English Program. Students who do not achieve scores on the TSE, TOEFL iBT, or IELTS high enough to satisfy the English proficiency requirements for graduate teaching assistants must enroll in the Developmental English Program and be certified for English proficiency before becoming eligible to hold a teaching assistantship. This 10-week program, offered by the UT Arlington English Language Institute, emphasizes oral presentation skills and

accent reduction. Registration is in 402 Hammond Hall, and the charge for course is payable at the time of registration. Contact the English Language Institute at 817-272-2730 for details, including the current class schedule and charges.

UNIVERSITY FACILITIES

A campus map can be found on the university website www.uta.edu/maps. Some of the more important facilities are listed below.

Office of Research and Graduate Studies (Graduate School)

The Graduate School is located in Davis Hall Room 333. The staff in that office can answer questions and supply the forms that you will need while you are enrolled here.

Libraries

The University has three libraries: the Central Library, the Science and Technology Library, and the Architecture and Fine Arts Library. A full description of the library system is given in the graduate catalog. The library contact for ME is Ms. Barbara Howser (howser@uta.edu).

Computer Labs

Computer Labs for student use can be found on campus in the following locations:

- Ransom Hall
- Central Library (5th floor)
- Carlisle Hall (in the writing center-5th floor)
- Nedderman Hall (basement)
- Science Learning Center, Life Science Building
- ME CADLAB, 320 Woolf Hall

Keys

A Key Request Form should be obtained from an administrative assistant in Room 204 Woolf Hall. The form should be signed by your supervising faculty member, as well as by the MAE Department Chairman. After all signatures are obtained, the form will be forwarded to the Key Control Office.

Mailboxes

ME graduate student (with GTA or GRA appointments) mailboxes are located in Room 214C Woolf Hall. Please check your mailbox daily since you will be notified of important happenings by notice in your mailbox.

Health Center

A health center is available to meet your medical needs. A full description of the services offered by the health center

can be found on the university website
www.uta.edu/health_services.

E.H. Hereford University Center

The E.H. Hereford University Center has numerous facilities and offices of interest to all students. In it are 13 private dining-meeting rooms, lounges, two ballrooms, four food service areas, bowling and billiards, a post office, general store, bank, gallery, and video room. The center is also home to 160 campus student organizations, the Student Congress, and the Student Activities Board. The Housing Office and the International Office are also located in the Center.

Maverick Activities Center

Students will find the Maverick Activities Center (MAC) offers many recreational facilities and activities. The 190,000 square foot facility is described on website www.uta.edu/campusrec/. A Mav ID card is required for entry. MAC facilities include: internet café with juice bar (wired and wireless connection), 20,000 square foot weight and fitness room, multipurpose rooms — yoga, martial arts, aerobics, etc., five indoor basketball courts, eight volleyball courts, indoor soccer gymnasium, two indoor tracks, six racquetball courts, ten badminton courts, game room and table tennis, climbing wall, two outdoor volleyball courts, two outdoor basketball courts, and men's and women's health club style locker rooms.

REQUIREMENTS OF THE PhD PROGRAM

The ME PhD degree program involves course requirements, a Diagnostic Exam, a Comprehensive Exam, research, and dissertation/defense. In this section the entire process is provided in detail. Please read this carefully and refer to it often. The ME faculty expect doctoral students to complete the various portions of the PhD program in a timely manner. Additionally, the Graduate School has firm deadlines each semester that all graduate students must comply with. Do not expect exceptions for deadlines, such as scheduling the dissertation defense, filing for graduation, and filing the final dissertation.

Typical Timeline for Coursework, Diagnostic Exam, and Comprehensive Exam

The ME faculty expect students to make consistent progress toward the PhD degree. The following timeline is expected of doctoral students. In particular, students must schedule the Diagnostic Exam and Comprehensive Exam within the timeframe detailed below.

Courses - depending on the amount of applicable prior Master's coursework, doctoral courses are normally completed in the first two and a half years.

Diagnostic Exam – the Diagnostic Exam is to be taken within one year of entering the doctoral program. Most students take the exam after two semesters of full time enrollment. *BS-PhD Track students* take this exam after three semesters of enrollment. The exam is given twice a year, in the week prior to the start of the fall or spring semester.

Comprehensive Exam – this exam is to be taken within one year after passing the Diagnostic Exam.

The First Year

During the first visit with the ME Graduate Advisor, you will discuss the planned courses that you will take your first semester. If you have graduate course work from another university, the Graduate Advisor (with the consent of the Chairman, ME Committee on Graduate Studies) is empowered to waive course requirements, if the student can show previous course work which is equivalent to that offered at UT Arlington. A full and formal acceptance of

applicable coursework taken at other universities is conducted subsequent to your first advisement meeting with the Graduate Advisor.

Your first year is usually devoted primarily to course work, with particular attention to preparation for the PhD Diagnostic Exam. This year and each following year a full time student will enroll in at least 9 hours of course work/research per semester. The details of the course offerings are listed in the Graduate Catalog, and the requirements that pertain to you are those listed in the catalog current at the time you enter the graduate program. The Graduate School requires that you maintain a 3.0 GPA (on a 4 point scale) in all course work taken as a graduate student.

During the first semester you are encouraged to talk to a large number of department faculty members regarding working under their supervision for dissertation research. (A listing of ME faculty is provided in *Appendix A*.) It is expected that by the end of your first semester you will find a faculty advisor who will agree to work with you. Students who fail to obtain a research advisor in during their first year of full time study may not be allowed to continue enrollment in the doctoral program.

BS-PhD Track Students. Special provisions apply to BS-PhD Track students. A BS-PhD student will be required to enroll in at least three hours of research each semester during the student's first two years, receiving a pass/fail grade (no R grade) in these hours. A BS-PhD student must have a faculty research (dissertation) advisor prior to the start of the student's second full semester. A BS-PhD student must take the PhD Diagnostic Exam prior to the start of the student's fourth full semester.

Degree Requirements

The PhD degree program involves course requirements, a diagnostic exam, a comprehensive exam, research, and dissertation/defense. A student's research must be directed by a UT Arlington faculty member approved by the ME Committee on Graduate Studies.

The PhD degree requires the successful completion of the following requirements:

1. Three core courses (nine credit hours) listed for the MS and M.Engr. degrees.

2. One additional course (three credit hours) at the graduate level in one of the broad areas of mechanical engineering outside the student's major area of specialization. Core courses are also acceptable for meeting this requirement.
3. Eight additional courses (24 credit hours) in the student's major area of interest. A Master's thesis can be used to substitute for six (6) credit hours.
4. Two courses (six credit hours) of engineering analysis (ME 5331, 5332, or other approved mathematics courses).
5. Two courses (six credit hours) of mathematics, numerical analysis, computer science, or statistics, outside of mechanical engineering.
6. Two courses (six credit hours) in science and/or engineering outside of mechanical engineering.
7. Nine credit hours (ME 6999) for Dissertation.

Final course requirements are approved by the student's supervising committee, the ME Graduate Advisor, and the Chair, ME Committee on Graduate Studies. In addition, a student must pass three examinations before being awarded the PhD degree: the Diagnostic Exam, the Comprehensive Exam, and the Final Exam (or Dissertation Examination).

A form for tracking courses taken in the ME PhD program is provided in **Appendix B**. This form is to be completed and filed with the Graduate Advisor when a student is nearing completion of courses. Also, students are required to file the Degree Plan Worksheet prior to the anticipated graduating semester. This form is provided in **Appendix C** and it is also available on the Graduate School website: <https://grad.uta.edu/pdfs/Current/DegreePlanWorksheet.pdf>. The forms given in **Appendices B and C** are used to verify that the student's Graduate Maverick Academic Progress Report (GMAP) is correct. The GMAP is the official document used by the Graduate School to certify completion of degree requirements.

Research

Research for the PhD program will begin usually during the second semester of course work, and will continue until your advisor and advisory committee think that you are ready to defend your work. A student's research must be directed by a UT Arlington faculty member approved by the ME Committee on Graduate Studies.

Diagnostic Exam

A Diagnostic Exam will be administered to the student within the first two semesters after a Master's degree or before the accumulation of 42 semester hours of graduate work beyond the baccalaureate degree. The Diagnostic Exam is a written test of the student's capability to pursue successfully the doctorate degree, and it aids in developing the program of study for the student. The Diagnostic Exam tests for fundamental knowledge in two technical areas of mechanical engineering and mathematics. The student and the student's research advisor jointly choose the technical area from the following five: (1) thermal science, (2) fluid science, (3) mechanical design and manufacturing (4) solid mechanics and structures, and (5) controls and systems. The exam topics for the technical areas are given in the *Guidelines for the Diagnostic Exam in Mechanical Engineering*, which is provided in *Appendix D*. The Diagnostic Exam is offered the week prior to the fall and spring semesters each year. After evaluating the exam, the Diagnostic Exam Committee submits the Diagnostic Evaluation Report (*Appendix E*) to the Graduate School.

Comprehensive Exam

A Comprehensive Exam will be administered to the student after the successful completion of all requirements of the Diagnostic Exam and after the student starts research work for the dissertation. The exam is to be scheduled within one year after passing the Diagnostic Exam. The Comprehensive Exam is used to determine if the student has the necessary background and specialization required for the dissertation research and if the student can organize and conduct the research. Specific instructions for preparing for the exam are provided in *Guidelines for the Comprehensive Exam in Mechanical Engineering (Appendix F)*.

The student forms the expected dissertation committee prior to this exam, with the assistance of the student's research advisor. The committee must have at least five members, with the majority of members being from the ME faculty. The student then schedules the exam with the Graduate School, using the form Request for the Comprehensive Exam (*Appendix G*). After evaluating the exam, the Comprehensive Exam Committee submits the Comprehensive Examination Report form (*Appendix H*) to the Graduate School.

Dissertation Defense

The final requirement for the PhD degree is the submission and oral defense of a dissertation which describes the results of your work. The student must file the Request for Dissertation Defense form (*Appendix I*) with the Graduate School two weeks prior to the defense. The dissertation committee is the same as the advisory committee for the defense of your original research proposal given in your Comprehensive Exam. The dissertation must be prepared according to the regulations of the Graduate School. The Graduate School has prepared a template for student use entitled *UTA Thesis and Dissertation Guide: Requirements, Style and RAFT Template*. It is found on website:

<https://orgs.uta.edu/CurrentStudents/raft.asp>. A copy of the dissertation must be given to each committee member two weeks in advance of the exam. This copy should be in a form so that it could be turned in as the final version. It should not be left for the committee to make major corrections and revisions in spelling, syntax, organization, or content of the dissertation. A dissertation in need of major rewriting will result in automatic failure at the first oral defense. At the oral defense you will give a brief presentation of your research and answer questions from the committee and the audience. After the public part of the exam, there will be a final question-and-answer session that involves only the student and the committee. Following the oral defense, the Dissertation Defense Report form must be submitted to the Graduate School (*Appendix J*). You must see that any conditions placed on passing are met in the time allowed and to the satisfaction of the committee members.

Graduating Semester

In the semester that you plan to graduate, there are several important deadlines that you must meet and fees that are to be paid. You should check the Graduate School's website (<http://grad.uta.edu/CurrentStudents/VirtualGraduateSchoolAdvisor.asp>) for these deadlines and fees. A graduation checklist is provided at this website (*Appendix K*). *Appendix L* (Application for Graduation) and *Appendix M* (Thesis and Dissertation Data Sheet) are additional forms that are filed during the graduating semester

Academic Probation

If your GPA falls below 3.0 at any time, you are automatically put on academic probation by the Graduate School. You are given one long semester (fall or spring) to raise your GPA to a 3.0. The ME Graduate Advisor and the Chair, ME Committee on Graduate Studies, shall meet at the end of each semester to review the progress of all graduate students on academic probation. Under very special circumstances the Committee on Graduate Studies may approve a student's petition to the Graduate School to continue on academic probation for another long semester. The petition must ultimately be approved by the Graduate School. However, do not depend on this to keep you in school. Keeping your GPA at 3.0 or better is extremely important and a major responsibility on your part. Keep your research advisor and Graduate Advisor informed, as your advisors may be able to assist you when you are having difficulties in your courses.

APPENDICES

- A. Mechanical Engineering Faculty
- B. Mechanical Engineering PhD Degree Program Form
- C. Degree Plan Worksheet
- D. Guidelines for the Diagnostic Exam in Mechanical Engineering
- E. Diagnostic Evaluation Report
- F. Guidelines for the Comprehensive Exam in Mechanical Engineering
- G. Request for the Comprehensive Exam
- H. Comprehensive Exam Report
- I. Request for Dissertation Defense
- J. Dissertation Defense Report
- K. Graduation Checklist
- L. Application for Graduation
- M. Thesis and Dissertation Data Sheet

APPENDIX A

Mechanical Engineering Faculty

MECHANICAL ENGINEERING FACULTY

Dereje Agonafer
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APPENDIX B

Mechanical Engineering PhD Degree Program Form

APPENDIX C

Degree Plan Worksheet

APPENDIX D

Guidelines for the Diagnostic Exam in Mechanical Engineering

Mechanical Engineering

Ph.D. Diagnostic Exam

Students are examined in **two major technical areas and applied at the graduate level.**

The students choose the technical areas from the following:

1. **Thermal Science** (Thermodynamics, Fluid Mechanics, Heat Transfer)
2. **Fluid Science** (Basic Fluid Mechanics Concepts, Ideal Fluid Flows, Viscous Incompressible Flows)
3. **Solid Mechanics and Structures** (Statics, Dynamics, and Strength of Materials)
4. **Dynamic Systems and Controls** (Modeling, System Dynamics, Feedback Controls)
5. **Mechanical Design** (Kinematics, Robotics, Mechanization of Motion, Mechanical Design)

The Diagnostic Exam is a written test of the student's capability to pursue successfully the Ph.D. and aids in developing a program of study appropriate for the student. The examination is to be administered to the student within the first two semesters after a Master's degree or before the accumulation of 42 semester hours of graduate work beyond the baccalaureate degree. The Ph.D. Diagnostic Examination will be administered in accordance with procedures set by the ME Ph.D. Diagnostic Exam Committee. A student who fails this examination may repeat it for a second time. The examination may not be taken more than twice. If a student fails the second time, the Ph.D. Diagnostic Examination Committee may recommend to the ME Graduate Studies Committee that the student be dismissed from the program.

Procedure for ME Ph.D. Diagnostic Examination

1. The Ph.D. Diagnostic Examination will be offered the week prior to the Fall and Spring semesters. The Ph.D. Diagnostic Examination Committee will be responsible for executing examination procedures.
2. A written announcement will be posted at least one month prior to the examination date.

3. Any graduate student desiring to take the Diagnostic Exam shall notify the ME Graduate Advisor, in writing, no later than one month prior to the exam, indicating the technical area, chosen from the areas listed below. A form is available for this purpose from Debi Barton. Selection of the technical areas must be approved by the student's dissertation advisor.

The exam topics for the various technical areas and applied mathematics are given in the following sections.

For further information regarding the PhD Diagnostic Exam, please contact Debi Barton or Professor Albert Tong, ME Graduate Advisor

Thermal Science

Heat Conduction

- Steady state heat conduction in one-dimension
- Heat conduction in two or more independent variables
- Unsteady heat conduction (lumped capacitance concept)
- Transient solutions with separation of variables

Analytic Solutions to Problems of Forced Convection

- Heat and momentum transfer for laminar and turbulent flow inside tubes
- Heat and momentum transfer for laminar and turbulent external boundary layers

Heat Transfer by Free Convection

- Analytical solutions of free convection past vertical plane surfaces
- Mixed free and forced convection

Thermodynamics

- First law for a control volume
- Steady state steady flow assumptions
- Uniform state uniform flow assumptions
- Second law for a control volume
- Enthalpy, internal energy, entropy
- Specific heats
- Work and heat

Applied Thermodynamics

- Cycles (Rankine, Carrot, refrigeration, vapor compression, Diesel, Otto) and applications
- Gas mixtures (water vapor and air mixture)

Suggested Textbooks:

“Fundamentals of Classical Thermodynamics” by Moran and Shapiro; Wiley 3rd Edition (1995)

“Fundamentals of Heat and Mass Transfer” by Incropera; Wiley. 4th Edition.

Fluid Science

Basic Fluid Mechanics Concepts

- Conservation of mass; Conservation of energy
- Navier-Stokes equations
- Euler equations
- Constitutive equations
- Streamlines, pathlines, and streaklines
- Stream tubes and vortex tubes
- Circulation and vorticity; Vorticity equations
- Kinematics of vortex lines
- Kelvin's theorem
- Reynolds' transport theorem
- Benoulli equation
- Flow separation
- Fluid statics
- Dimensional analysis
- Control volume analysis

Ideal Fluid Flows

- Two-dimensional potential flows
- Source, sink, and vortex
- Flow in a sector
- Flow around a sharp edge
- Flow over a cylinder with and without circulation
- Flow around ellipses
- Kutta condition
- Complex potential
- Conformal mapping
- Joukowski transformation
- Blasius integral laws

Viscous Incompressible Flows

- Pipe flow
- Moody chart
- Couette Flow
- Poiseuille Flow
- Flow between rotating cylinders
- Stokes' first problem; Stokes' second problem
- Falkner skan flow
- Blasius solution
- Stagnation point flow
- Karman-Pohlhausen approximation

Suggested Textbook:

“Fundamental Mechanics of Fluids” by I. G. Currie,
Marcel Dekker, 3rd edition (2003)

Solid Mechanics and Structures

Structural Statics and Finite Element Analysis (ME 5310)

- Finite Element Stiffness Matrix
- Lumped and Consistent Load Vector
- Lumped and Consistent mass matrices
- Static Response of Complex Structures
- Error estimation
- Shape functions

Structural Dynamics and Vibration (ME 5311)

- Single degree-of-freedom (SDOF) system
- Multiple degrees-of-freedom system
- Natural Frequency and Mode Shape
- Lagrangian Equations
- Continuum System
- Forced Responses
- Damped and Undamped Systems

Solid Mechanics and Strength of Materials (ME 5339)

- Stress, strain and deflection of structural Members under tension, bending, compression and torsional loads
- Principal stresses/ Octahedral stresses
- Axisymmetrically Loaded member
- Column Stability (Long and Short Column)
- Energy Methods
- Failure Criteria
- Stress Concentration Factor
- Thermal Stresses
- Thin-Wall Structures
- Fatigue Crack propagation
- Strain Life/Stress Life

Suggested Textbook:

Ugural & Fenster, "Advanced Strength and Applied Elasticity", 4th edition

Dynamic Systems and Controls

Dynamic Systems

- First and second-ordered systems characteristics (static gain, time constant, damping ratio, natural frequency)
- Input test signals (impulse, step, ramp)
- Time domain response (time constant, settling time, damping ratio, overshoot)
- State space representation
- Digital simulation concepts

Modeling of Dynamic Systems

- Systems similarity, effort and flow variables
- Modeling of simple mechanical, electrical, hydraulic, pneumatic, and thermal systems
- Modeling of electric or hydraulic position servo system

Control System Analysis

- Laplace transform
- Transfer functions
- Block diagrams
- Static gain, initial value and final value theorems
- Transient response
- Frequency response, Bode plots
- Root locus analysis
- Stability analysis (Routh, root locus, eigenvalues)

Control System Design

- Types of controllers
- Effects of each controller
- Using root locus to achieve desired eigenvalues
- Using frequency domain techniques to achieve desired phase and gain margins
- Using state variable feedback to achieve desired eigenvalues

Suggested Textbooks:

Woods and Lawrence, "Modeling and Simulation of Dynamic Systems", Prentice Hall, 1997

Dorf and Bishop, "Modern Control Systems", Addison-Wesley, 1998

K. Ogata, "Modern Control Engineering", Prentice-Hall, N.Y. 1970.

K. Ogata, "System Dynamics", Prentice-Hall, N.Y. 1978.

W.Palm, III, "Modeling, Analysis and Control of Dynamics Systems", John Wiley, N.Y. 1983.

B. Freidland, "Control System Design; A State Space Approach", McGraw Hill, N.Y. 1986.

Mechanical Design

- Simple stresses, Mohr's circle applications
- Combined stresses
- Deflections
- Columns
- Static failure theories
- Fatigue failure theories
- Design of machine components: Shafts, Bearings, Gears, Springs, Fasteners
- Mechanism analysis: Displacements, Velocities, Accelerations, Dynamic and static forces
- Robotics (Recommended Textbook: Introduction to Robotics by J. Craig)
- Coordinate Frames, Compound Transformations, Homogeneous Transformation
- Forward and Inverse Kinematics Analysis for Serial Link Robots
- Dynamic Analysis of Serial Link Robots
- Fundamental Control Issues for Robots
- Accuracy and Repeatability Notions for Robotic Manipulators

Suggested Textbooks:

"Introduction to Robotics" by J. Craig

"Robot Dynamics and Control" by Spong and Vidyasagar

"Modeling and Control of Robots Manipulators" by Sciavicco and Siciliano

"Mechanism Design" by Erdman and Sandor

"Design of Machinery: An Introduction To The Synthesis and Analysis of Mechanisms and Machines", by R. L. Norton

"Machine Design: An Integrated Approach", Second Edition by R. L. Norton,

**Mechanical Engineering Ph.D. Diagnostic Examination
Registration
Department of Mechanical and Aerospace Engineering
The University of Texas at Arlington**

Semester: _____ Year: _____

Name:

_____ Last First Middle Initial

Student ID Number:

Address:

E-mail:

Phone Number:

I will take the Ph.D. Diagnostic Exam in the two technical areas indicated below
(to be approved by student's dissertation advisor):

- Thermal Science
- Fluid Science
- Solid Mechanics and Structures
- Dynamic Systems and Controls
- Mechanical Design

Dissertation Advisor Approval:

Signature

Date

Turn in form to Debi Barton, Room 204 Woolf Hall

APPENDIX E

Diagnostic Evaluation Report

APPENDIX F

Guidelines for the Comprehensive Exam in Mechanical Engineering

Guidelines for the Comprehensive Exam in Mechanical Engineering

**In partial fulfillment for the Ph.D. Degree
in Mechanical Engineering at
The University of Texas at Arlington**

**DEPARTMENT OF MECHANICAL AND AEROSPACE
ENGINEERING**

The University of Texas at Arlington
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University and Departmental Requirements

The Graduate School of The University of Texas at Arlington requires all doctoral students to pass a Comprehensive Exam. In the Mechanical Engineering Program, this exam consists of both a written document and an oral presentation of the student's proposed dissertation research. The Mechanical Engineering faculty requires that full time doctoral students take this exam within twelve months following successful passage of the Diagnostic Exam. For most students the Comprehensive Exam ordinarily will be taken during the student's second year of doctoral studies. At this point a doctoral student should have commenced concentrated work on dissertation research under a faculty advisor and established a Comprehensive Exam Committee of at least five qualified faculty members. Faculty serving on the committee typically are ME faculty, but faculty in other UTA departments and programs and other qualified professionals can be certified to serve on this committee by the Mechanical Engineering Committee on Graduate Studies. Members of the Comprehensive Exam Committee are expected to serve later on the student's dissertation committee.

The Comprehensive Exam is used to determine if the student has the necessary background and specialization required for the dissertation research and if the student can organize and conduct the research. An applicant must pass this examination to be admitted to candidacy for the Ph.D. degree. The Comprehensive Examination may result in: (1) unconditional pass and recommendation to proceed to the next phase of the program; (2) approval to remain in the program but a requirement to meet certain specified additional criteria; (3) failure, but with permission to retake the examination after a period specified by the examining committee; or (4) failure with recommendation not to continue in the program.

The student must set the exam date with the agreement of the committee members and file the "Request for the Comprehensive Examination" with the Graduate School at least 14 days prior to the exam date. The exam specifically involves evaluation of the student's dissertation research proposal. A written proposal document is to be provided to all committee members at least 7 days prior to the exam date. On the day of the exam, the student is to provide the committee members copies of the presentation material that is to be covered. This document details guidelines for students in preparing the written proposal.

Although the topic and scope of the proposed research should be determined with the consent of the student's research advisor, the proposal must be developed and written by the student, not by the advisor. Since this is an exam, the role of research advisor should be very limited. Excessive comments and document editing by the advisor are prohibited.

Written Proposal Format

The dissertation research proposal needs to be presented in a succinct manner. The document (excluding Appendices) should be limited to no more than 30 pages. Visual materials, including figures, tables, etc., are included in the 30 page limit. Pages should be standard letter size with margins of 1 inch at the top, bottom, and on each side. The type font size must be no smaller than 12, and the line spacing must be double-spaced. Students are encouraged to adopt, as appropriate, format and styles required by the Graduate School for dissertations. (<http://orgs.uta.edu/CurrentStudents/raft.asp>).

The proposal should typically contain the following sections:

Title Page (one page)

Project Summary (maximum of two pages)

Table of Contents (maximum of three pages)

Project Description (maximum of 20 pages)

References (maximum of four pages)

Appendices (additional pages as appropriate)

Comments on each of these sections are detailed below.

Title Page

- The proposed research title should be brief, clear, and unambiguous.
- Use words that clearly reflect the focus of your proposal.
- Remove words from the title that are unnecessary.
- Include your name, your advisor's name (Committee Chairman), the names of the other members of the Comprehensive Exam Committee, and the date.

Project Summary

- The Project Summary provides the reader with a "picture" of your proposal.
- It must be concise and lay the framework of your proposal.
- This section should be prepared last, after you have written the rest of the proposal and you have a clear understanding of what follows in the document.

- Make sure that the reader sees:
 - (1) objectives of the research and expected significance
 - (2) reasons for the research
 - (3) the uniqueness of the work
 - (4) a clear rationale
 - (5) focused ideas
 - (6) a summary of work done thus far
 - (7) a summary of work that remains to be done

Table of Contents

- The Table of Contents lists all main sections and subheadings contained in the document, with appropriate page numbers.

Project Description

- The purpose of the Project Description is to provide the *what*, *why*, and *how* of the proposal.
- The Project Description contains all elements that are condensed in the Project Summary.
- It should contain discussion of:
 - (1) objectives of the research and expected significance
 - (2) reasons for the research
 - (3) the uniqueness of the work
 - (4) what you intend to do and why it is worth doing
 - (5) what you have done to establish the feasibility of what you are proposing
 - (6) how the research will be accomplished
 - (7) relation of your proposed research to the present state of knowledge in the field; cite appropriate references
 - (8) identification of required resources
 - (9) a projected sequence and schedule
 - (10) potential difficulties and limitations and how these will be overcome or mitigated
 - (11) expected results and alternative approaches if unexpected results are found
 - (12) discussion of what work has been done thus far, including experimental procedures, analysis methods, and results
 - (13) contributions: what your work adds to the field of knowledge

References

- The proposal should cite essential references pertinent to the subject being addressed.
- Every reference cited in the proposal must be listed in this section.

- Citations must be complete. Include full listing of authors, the title of the article, name of the journal or book, publisher (if a book), volume number, page numbers, and date.
- Use a consistent bibliographic style.

Appendices

- There is no page limit for supporting information provided in Appendices.
- Appendices contain materials too lengthy for inclusion in the text, or not directly relevant. The Appendices may be useful for providing raw data, background materials, supplemental tables, figures, derivations, analysis, etc.
- All material in Appendices must be referred to in the text so readers know why they are there.
- Each Appendix should have a title.

Common Shortcomings

The following list details common deficiencies in research proposals:

- It is not clear what hypothesis is being addressed by the proposal.
- It is not clear that the proposed hypothesis is worth addressing.
- The case for innovative research (i.e., the contribution) is not made.
- The proposed research is just a routine application of known techniques.
- The proposer seems unaware of what others have done in this field.
- There is no evidence that the proposer will succeed where others have failed.
- The proposer is attempting too much.
- The approach lacks clear thinking and logical development.
- The resources are not adequate for the proposed research.

Resources for Writing Proposals and Dissertations

There are many resources available via the internet for writing proposals and dissertations. In particular, many universities have excellent information via their Office of Sponsored Projects or Graduate School sites. The following is a list of some very helpful web sites:

S. Joseph Levine, Ph.D., Michigan State University – “Guide for Writing a Funding Proposal”

<http://learnerassociates.net/proposal/>

S. Joseph Levine, Ph.D., Michigan State University – “Guide for Writing and Presenting Your Thesis or Dissertation”

<http://www.learnerassociates.net/dissthes/>

University of Vermont, Office of Sponsored Projects – “Grant Writing Resources”

<http://www.uvm.edu/~ospuvvm/?Page=guides.htm>

University of North Carolina, Chapel Hill, Research at Carolina – “Proposal Writing Resources”

http://research.unc.edu/grantsource/proposal_writing.php

The University of Washington, The Graduate School – “Obtaining a Ph.D.”

http://www.grad.washington.edu/envision/phd/obtaining_phd/dissertation2.html

Foundation Center – “Proposal Writing Short Course”

http://foundationcenter.org/getstarted/tutorials/shortcourse/prop1_print

National Science Foundation (NSF) – “A Guide to Proposal Writing”

<http://www.nsf.gov/pubs/2004/nsf04016/start.htm>

National Cancer Institute – “Quick Guide for Grant Applications”

<http://deainfo.nci.nih.gov/extra/extdocs/gntapp.htm>

APPENDIX G

Request for the Comprehensive Exam

APPENDIX H

Comprehensive Exam Report

APPENDIX I

Request for Dissertation Defense

APPENDIX J

Dissertation Defense Report

APPENDIX K

Graduation Checklist

APPENDIX L

Application for Graduation

APPENDIX M

Thesis and Dissertation Data Sheet