MASTER'S PROGRAM IN MECHANICAL ENGINEERING

GUIDE FOR EXISTING AND PROSPECTIVE GRADUATE STUDENTS

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TABLE OF CONTENTS

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PROGRAM OVERVIEW

The Department of Mechanical Engineering offers a graduate program leading to a Master of Science in Engineering Degree. The program has a thesis option, a non-thesis option, and a project with report option. Coursework is offered in areas including Mechanics and Design, Materials, and Thermal-Fluid Sciences. Potential research opportunities exist in combustion, nanotechnology, MEMS and NEMS, smart structures, biomechanics, robotics, mechatronics, acoustics and vibrations, materials science, solid mechanics, laser material processing, experimental heat transfer and fluid mechanics, thermal and dynamic analysis of railroad bearings, and bearing condition monitoring.

ADMISSION REQUIREMENTS

Applicants must first meet all requirements for graduate admission to UT Pan American, as well as the other requirements listed below. Application for admission must be submitted online; the application is available at www.utpa.edu/gradschool. Once submitted, applicants can check the status of their applications online or by contacting the Graduate Office.

For **unconditional** admission, the student must:

(1) Have a bachelor's degree in mechanical engineering or a related area with a grade point average of 2.75 or higher on a 4.0 scale.

(2) Attach or request through their online application three letters of recommendation attesting to the applicant's academic potential and capability for performing graduate-level work in mechanical engineering.

Applicants who do not satisfy the specific program criteria above will be considered for conditional admission. Those with a bachelor's degree in a field other than mechanical engineering may be admitted subject to completion of a set of undergraduate leveling courses prescribed by the Graduate Program Director. Students admitted conditionally must successfully complete all leveling courses, if any, and successfully complete their first six hours of graduate work with a grade of "B" or higher.

MASTER OF SCIENCE DEGREE
MECHANICAL ENGINEERING
THESIS OPTION

DEGREE REQUIREMENTS

COURSE REQUIREMENTS

The thesis option for the Master's degree requires a minimum of 30 hours of graduate work selected as follows:

A. Twelve hours of **required** coursework
   1. MECE 6310 Intermediate Engineering Analysis
   2. MECE 6320 Fracture Mechanics
   3. MECE 6341 Modeling of Physical Systems
   4. MECE 6372 Viscous Flow I

B. Six hours of Thesis
   1. MECE 7300 Master's Thesis I
   2. MECE 7301 Master's Thesis II

C. Twelve hours of additional courses chosen with the consent of the student's adviser. At least six hours must be in mechanical engineering, and up to six hours may be selected from other programs but **must** be approved by the student's adviser and the graduate program director.

GENERAL REQUIREMENTS

1. The Graduate Program Director will help the student prepare an initial plan of study to begin his/her first semester of graduate work. During the first semester, the student is urged to discuss potential research topics with several faculty members, in order to choose a topic that interests him/her and a major professor to act as his/her thesis adviser. When a thesis topic has been selected, a Graduate Committee composed of at least three graduate faculty members shall be formed in conjunction with the major professor and the Graduate Program Director. The committee should include at least two Mechanical Engineering faculty members from UTPA and one faculty member can be from another department; however, the Chair of the committee must be from the UTPA Mechanical Engineering Faculty. All Graduate Committee members must have current Graduate Faculty Status. An approval of

the student Graduate Committee by the University Graduate Office is required before the student begins the thesis work. A final plan of study must be prepared and approved by the major professor, the Graduate Program Director, the Department Chair, and the Dean no later than the second semester of graduate work.

2. Each student should submit a proposal to their Graduate Committee which describes the thesis topic in sufficient detail to satisfy the Committee. A copy of the proposal should also be submitted to the Graduate Program Director. The proposal should be submitted before the student signs up for his/her first thesis course. Students should bear in mind that a master's thesis should be publishable in the technical literature and represent some meaningful extension of state of knowledge in the field.

3. Once a student registers for and successfully completes MECE 7300, he/she must continue to register for MECE 7301 each succeeding semester or summer session until the thesis is completed. Credit for MECE 7301 is counted only once and then only upon successful completion of the master's program.

4. Each student is required to present a seminar on the thesis topic. Notice of the oral presentation of the Master's thesis should be given at least one week in advance to all faculty and students in the Department. A draft copy of the Master's thesis should be made available to all faculty members serving on the student's Graduate Committee at least one week before the thesis defense. Students are expected to make changes to the final copy of their Master's thesis based on feedback obtained from the oral presentation. During the thesis defense, students should expect to be asked fundamental questions that evaluate their depth of knowledge in the field of study. It is the responsibility of the student to contact the Graduate Program Director to schedule the thesis defense at least four weeks before the defense date. If the student fails the thesis defense, he/she may be allowed to take a second defense contingent upon the approval of the Graduate Committee, the Graduate Program Director, the Department Chair, and the Dean of the College. If approved, the timing and requirements of the second defense will be specified by the Graduate Committee, but in no case will the student be able to defend his/her thesis for the second time until at least one semester has passed. After two failures, no further thesis defense is allowed, and the student can no longer obtain his/her Master's degree under the thesis option.

5. Students are responsible for preparing and copying the final thesis. One copy must be provided to the major professor, and one copy to the Department in addition to copies required by the University Graduate Office. Members of the student's Graduate Committee may each require to be provided with a copy of the thesis. It is the responsibility of the student to adhere to the University requirements for the format and submission of a thesis.

6. All candidates for the Master of Science degree must maintain a minimum GPA of 3.0 throughout their program of study. Any student with clear admission whose GPA falls below 3.0 will be placed on probation. To remain in the graduate program, the student must restore his/her GPA to 3.0 by the end of the following semester. Failure to do so will result in the student being suspended from the graduate program (see suspension appeal process).

7. Students are responsible for applying for graduation with the Office of Graduate Studies located in the Administration Building, Room 116. Students must apply for graduation by the published deadline in the University calendar which is approximately nine months prior to the intended date of graduation. All graduate forms required by the University Graduate Office along with specific instructions can be found in their Web Site at www.utpa.edu/gradschool.

MASTER OF SCIENCE DEGREE
MECHANICAL ENGINEERING
PROJECT WITH REPORT OPTION

DEGREE REQUIREMENTS

COURSE REQUIREMENTS

The project with report option for the master's degree requires a minimum of 36 hours of graduate work selected as follows:

A. Twelve hours of **required** coursework
   1. MECE 6310 Intermediate Engineering Analysis
   2. MECE 6320 Fracture Mechanics
   3. MECE 6341 Modeling of Physical Systems
   4. MECE 6372 Viscous Flow I

B. Six hours of Project Report
   1. MECE 6397 Masters Report I
   2. MECE 6398 Masters Report II

C. Eighteen hours of additional courses chosen with the consent of the student's adviser. At least twelve hours must be in mechanical engineering, and up to six hours may be selected from other programs but **must** be approved by the student's adviser and the graduate program director.

GENERAL REQUIREMENTS

1. The Graduate Program Director will help the student prepare an initial plan of study to begin his/her first semester of graduate work. During the first semester, the student is urged to discuss potential projects with several faculty members, in order to choose a topic that interests him/her and a faculty member who is willing to sponsor his/her project. When a project topic has been selected, a Graduate Committee composed of three graduate faculty members shall be formed in conjunction with the sponsoring professor and the Graduate Program Director. The committee should include at least two Mechanical Engineering faculty members from UTPA and one faculty member can be from another department; however, the Chair of the committee must be from the UTPA Mechanical Engineering Faculty. All Graduate Committee members must have current Graduate Faculty Status. An approval of the student's Graduate Committee by the University Graduate Office is required before the student

begins the project work. A final plan of study must be prepared and approved by the sponsoring professor, the Graduate Program Director, the Department Chair, and the Dean no later than the second semester of graduate work.

2. Each student should submit a proposal to their Graduate Committee which describes the project in sufficient detail to satisfy the Committee. A copy of the proposal should also be submitted to the Graduate Program Director. The proposal should be submitted before the student signs up for his/her first report course. Students in this option should bear in mind that the Master's project should bring to them additional learning experience and be of some value to the technical field.

3. Once a student registers for and successfully completes MECE 6397, he/she must continue to register for MECE 6398 each succeeding semester or summer session until the report is completed. Credit for MECE 6398 is counted only once and then only upon successful completion of the master's program.

4. Each student is required to present a seminar on the project topic. Notice of the oral presentation of the Master's project should be given at least one week in advance to all faculty and students in the Department. A draft copy of the Master's project should be made available to all faculty members serving on the student's Graduate Committee at least one week before the oral presentation. Students are expected to make changes to the final copy of their Master's project based on feedback obtained from the oral presentation. During the oral presentation, students should expect to be asked fundamental questions that evaluate their depth of knowledge in the field of study. Students will be evaluated based on the work accomplished in their project, and their verbal and written communication skills. It is the responsibility of the student to contact the Graduate Program Director to schedule the examination at least four weeks before the examination date. If the student fails the oral examination, he/she may be allowed to take a second examination contingent upon the approval of the Graduate Committee, the Graduate Program Director, the Department Chair, and the Dean of the College. If approved, the timing and requirements of the second attempt will be specified by the Graduate Committee, but in no case will the second examination be given until at least one semester has passed. After two failures, no further oral examination is allowed, and the student can no longer obtain his/her Master's degree under the project with report option.

5. Students are responsible for preparing and copying the final project report. One copy must be provided to the sponsoring professor and one copy to the Department in addition to any copies required by the University Graduate Office. Members of the student's Graduate Committee may each require to be provided with a copy of the project report. It is the responsibility of the student to adhere to the report format and submission requirements approved by his/her Graduate Committee.

6. All candidates for the Master of Science degree must maintain a minimum GPA of 3.0 throughout their program of study. Any student with clear admission whose GPA falls below 3.0 will be placed on probation. To remain in the graduate program, the student must restore his/her GPA to 3.0 by the end of the following semester. Failure to do so will result in the student being suspended from the graduate program (see suspension appeal process).

7. Students are responsible for applying for graduation with the Office of Graduate Studies located in the Administration Building, Room 116. Students must apply for graduation by the published deadline in the University calendar which is approximately nine months prior to the intended date of graduation. All graduate forms required by the University Graduate Office along with specific instructions can be found in their Web Site at www.utpa.edu/gradschool.

MASTER OF SCIENCE DEGREE
MECHANICAL ENGINEERING
NON-THESIS OPTION

DEGREE REQUIREMENTS

COURSE REQUIREMENTS

The non-thesis (coursework) option for the Master's degree requires a minimum of 36 hours of graduate work selected as follows:

A. Twelve hours of **required** coursework
   1. MECE 6310 Intermediate Engineering Analysis
   2. MECE 6320 Fracture Mechanics
   3. MECE 6341 Modeling of Physical Systems
   4. MECE 6372 Viscous Flow I

B. Twenty-four hours of additional courses chosen with the consent of the student's adviser. At least eighteen hours must be in mechanical engineering, and up to six hours may be selected from other programs but **must** be approved by the graduate program director.

GENERAL REQUIREMENTS

1. The graduate program director will help the student prepare a plan of study during his/her first semester of graduate work and will act as the student's adviser during his/her graduate studies. A final plan of study must be prepared by the graduate program director, approved by the department chair and the dean of the college, and submitted to the Office of Graduate Studies within two semesters of the student's graduation date.

2. In addition to course requirements, each student under the coursework option will be required to pass an **oral** and **written** comprehensive examination within the final two semesters of the student's graduate studies. The comprehensive examination will be administered by an Examining Committee whose members are faculty from the major department with whom the student has taken one or more graduate courses. The Examining Committee will be appointed by the graduate program director, with approval of the department chair, and will evaluate the student's depth of knowledge in the field of study and his/her competence in retaining fundamental concepts and technical expertise. For the oral examination, each student is required to prepare and give a presentation on one or more course projects of their choice as

part of the MECE 6190 Engineering Seminar course which is offered every Fall and Spring semester. During their oral presentation, students should be prepared to answer fundamental and conceptual questions related to their major field of study, and will be evaluated based on the work accomplished in their course projects, and on their verbal communication skills. The written comprehensive examination will cover material from the **four** courses **required** by all students pursuing a Master of Science degree in mechanical engineering. The Examining Committee will consist of the faculty that teach these required four courses in conjunction with the graduate program director who will coordinate, supervise, and administer the written comprehensive examination. Students choosing to take their written comprehensive examination in a semester in which they are not enrolled in any mechanical engineering graduate courses **must** enroll in MECE 6190 Engineering Seminar to be eligible to take the exam.

3. The written comprehensive examination will be held on the Friday two weeks before the end of the Fall and Spring semesters. It will consist of two sessions, a morning session and an afternoon session, separated by a one hour lunch break. The morning session will start at 9:00 am and will end at noon, and the afternoon session will start at 1:00 pm and conclude at 4:00 pm. In each session, the students will be tested on two of the four courses. Special instructions for each test will be provided by the Examining Committee, at least four weeks in advance, to assist the students in preparing and studying for the written comprehensive examination. The Examining Committee will then have one full week to complete the grading process and report the results to the Graduate Program Director who will in turn inform the students of their results. The Graduate Program Director will also prepare and submit an official memorandum to the Vice Provost of Graduate Studies to report the results of the oral and written comprehensive examinations administered to all the mechanical engineering students in that specific semester.

4. Since the oral and written comprehensive examinations are only administered in the Fall and Spring semesters, it is the responsibility of the student to contact the Graduate Program Director to schedule their oral and written comprehensive examination at least one semester in advance. Failure to do so can result in delays in the student's scheduled graduation date.

5. If the student fails their oral and/or written comprehensive examination, he/she may be allowed to take a second examination contingent upon the approval of the Examining Committee, the Graduate Program Director, the Department Chair, and the Dean of the College. If approved, the timing and requirements of the second attempt will be specified by the Examining Committee, but in no case will the second examination be administered until at least one semester has passed. Moreover, the student **must** enroll in MECE 6190 Engineering Seminar to be eligible for the second attempt at the oral and/or written comprehensive examination. After two failures, no further examination is allowed, and the student will not be granted a Master's degree under the coursework option.

6. All candidates for the Master of Science degree must maintain a minimum GPA of 3.0 throughout their program of study. Any student with clear admission whose GPA falls below 3.0 will be placed on probation. To remain in the graduate program, the student must restore his/her GPA to 3.0 or higher by the end of the following semester. Failure to do so will result in the student being suspended from the graduate program (see suspension appeal process).

7. Students are responsible for applying for graduation with the Office of Graduate Studies located in the Administration Building, Room 116. Students must apply for graduation by the published deadline in the University calendar which is approximately nine months prior to the intended date of graduation. All graduate forms required by the University Graduate Office along with specific instructions can be found in their Web Site at www.utpa.edu/gradschool.

DUTIES AND RESPONSIBILITIES OF THE GRADUATE PROGRAM DIRECTOR IN THE MECHANICAL ENGINEERING DEPARTMENT

Graduate Program Directors perform a very important role for the Graduate Studies. Some of the graduate program director's duties and responsibilities are:

1. Serves as a liaison between the unit and the AVP for AA/GP&R.
2. Maintains the academic records of graduate student majors in the unit.
3. Registers and pre-registers graduate students in the unit.
4. Works with the Graduate Office in identifying graduate students in the program who are not performing well academically and should therefore be placed on scholastic probation.
5. Works with the international student adviser to ensure that the international graduate student majors in the unit maintain good standing.
6. Plans and attends trips to various universities and colleges for recruitment purposes.
7. Admits and rejects graduate student applicants in accordance to admission standards developed by the graduate faculty within the unit.
8. Resolves problems which may arise with graduate students in consultation with the graduate faculty in the unit.
9. In consultation with the graduate adviser ensures that the degree plans are in compliance with plans in the catalog.
10. Ensures that graduate policies are adhered to in the unit.
11. Certifies candidacy of students to the graduate dean.

The graduate student chooses a graduate adviser (Graduate Program Director could also be chosen as graduate adviser) who works closely with the graduate program director in administering the academic affairs of the graduate student. The graduate adviser counsels and advises graduate students on curricular matters, develops degree plans, and, in consultation with the graduate program director, ensures that the degree plans are in compliance with plans in the University catalog.

STUDENT ADVISING

The graduate program director will help the student prepare an initial plan of study to begin his/her first semester of graduate work. All students admitted to the mechanical engineering graduate program will be advised by the graduate program director. Students under the thesis or project with report option must meet with their research faculty adviser prior to meeting with the graduate program director in order to determine appropriate courses to be taken for their research projects.

TRANSFER OF GRADUATE CREDITS

A maximum of nine semester hours of graduate work earned at other institutions may be transferred for degree credit, **contingent upon review and approval by the Graduate Program Director and the Department Chair**. General procedure and criteria for transferring graduate credits are as follows:

1. The course is equivalent to a graduate level science/engineering course at UTPA or appropriate for elective credit (as in MECE 6399).

2. The grade for the course is "B" or higher.

3. The course was not earned by correspondence.

4. No more than seven years have passed between the date the course was completed and the planned graduation date of the student from UTPA.

Students who wish to transfer graduate credits must submit a request letter to the Graduate Program Director with supporting materials (such as detailed course descriptions or syllabi, samples of work, proof of completion of the course, etc.) no later than four weeks before the filing date of the official degree plan of the student with the University Graduate Office.

Students who plan on taking one or more graduate courses at other institutions while enrolled in the Mechanical Engineering Master's program at UTPA are encouraged to contact the Graduate Program Director to discuss the possibility of transferring the course credit upon completion to UTPA.

General Principles of Grading

Every course will have well-defined grading criteria established by the faculty teaching the course. A description of the faculty's grading scale and criteria will be provided in their course syllabus.

Students must obtain a minimum grade of "C" for the graduate course to count towards their Master's degree. However, all candidates for the Master of Science degree must maintain a minimum GPA of 3.0 throughout their program of study. Any student with clear admission whose GPA falls below 3.0 will be placed on probation. To remain in the graduate program, the student must restore his/her GPA to 3.0 or higher by the end of the following semester. Failure to do so will result in the student being suspended from the graduate program (see suspension appeal process).

Suspension Appeal Process

Students who fail to raise their GPA to 3.0 or higher after one semester of probation will be suspended from the graduate program. A student may appeal the suspension if he/she feels that he/she has a compelling argument as to reasons for failure to raise their GPA above the minimum required for clear status. The student will have to prepare, sign, and submit his appeal in written format to the Graduate Program Director. If approved by the graduate program director, he/she will send the appeal along with their decision in written format to the Department Chair. The department chair will then make a decision and forward the appeal along with his written decision to the Dean of the College who will review the appeal and forward his written decision to the Office of Graduate Studies. Final decision on the student's appeal will be made by the Vice Provost for Graduate Studies who will notify the student of their decision in writing. If approved by all parties involved, the student will be re-admitted to the graduate program on a probationary status. Probation will be lifted if the student is successful in raising his/her GPA to 3.0 or higher upon completion of one semester of work.

Request for Leave of Absence

Graduate students who intend to interrupt their studies for a semester or two to pursue an internship, a co-operative work experience, or for medical or personal reasons may submit a written request for a leave of absence to the Graduate Program Director at least four weeks in advance. Supporting evidence and documentation must be attached to the student's written request before a decision can be made on their case. The request will require the approval of the Graduate Program Director, the Department Chair, and the Dean of the College before being forwarded to the Vice Provost for Graduate Studies for final approval. Failure to submit a request for a leave of absence prior to the student's departure will result in the student losing his/her graduate standing in the program, and will require the student to apply for re-admission to the graduate program through the University Graduate Office upon his/her return.

Graduate Certificate Programs in Mechanical Engineering: Mechanics and Design, Materials, and Thermal-Fluid Sciences

Mission Statement

The Department of Mechanical Engineering will provide students and professionals a quality education to prepare them for the practice of engineering.

Background

Students and professionals interested in obtaining additional broad-based technical education in a selected mechanical engineering area of concentration will have the option of pursuing a graduate certificate program. The current mechanical engineering research and graduate teaching areas include: mechanics and design, materials, and thermal-fluid sciences.

The certificate program is a professional-oriented program designed for individuals who possess at least one degree in engineering or a closely-related field and desire additional specialized training in an area of mechanical engineering.

The certificate program makes available to working professionals valuable advanced training and professional development. The program is structured so that current employees can enhance skills relevant to employers' needs without leaving for training.

Certificate Programs Overview

This is a twelve hour program consisting of four graduate courses. All courses must be taken for a grade. Most of the mechanical engineering graduate courses are offered during the evening, which is convenient for working professionals. The number of courses offered may vary per semester.

Students receive a certificate upon completion of four graduate courses at UT Pan American in a chosen area from the mechanical engineering graduate courses' list with a minimum cumulative grade point average of 3.0 on a 4.0 scale.

ELIGIBILITY

UT Pan American undergraduate students are eligible to enroll in courses upon graduation. Students who are not currently enrolled must first meet all requirements for graduate admission to UT Pan American, as well as the other requirements listed below. Application for admission must be submitted online; the application is available at www.utpa.edu/gradschool. Once submitted, applicants can check the status of their applications online or by contacting the Graduate Office.

For **unconditional** admission, the student must:

(1) Have a bachelor's degree in mechanical engineering or a related area with a grade point average of 2.75 or higher on a 4.0 scale.

(2) Attach or request through their online application three letters of recommendation attesting to the applicant's academic potential and capability for performing graduate-level work in mechanical engineering.

Applicants who do not satisfy the specific program criteria above will be considered for conditional admission. Those with a bachelor's degree in a field other than mechanical engineering may be admitted subject to completion of a set of undergraduate leveling courses prescribed by the graduate program director. Students admitted conditionally must successfully complete all leveling courses, if any, and successfully complete their first six hours of graduate work with a grade of "B" or higher.

CONDITIONS AND LIMITATIONS

All courses for the certificate must be taken at the Department of Mechanical Engineering. Transfer graduate courses are **NOT** considered for the certificate.

The maximum time limit for completion of the certificate program is four years. In the fifth year, a student must begin on four new graduate courses to earn his/her certificate.

The credit for classes may be applied toward the Master of Science in mechanical engineering should the student decide later to pursue an advanced degree. For instance, obtaining three different certificates will grant the professional a Master's degree in mechanical engineering upon successful completion of an oral and written comprehensive examination.

- Certificate programs will be available in the following three areas:

  - **Mechanics and Design.**
    Choose four, three-unit courses from the following list:
    MECE 6310, MECE 6329, MECE 6331, MECE 6332, MECE 6333, MECE 6334, MECE 6335, MECE 6339, MECE 6341, MECE 6342, MECE 6343, MECE 6344, MECE 6360, MECE 6362, MECE 6399.

- **Materials.**
  Choose four, three-unit courses from the following list:
  MECE 6310, MECE 6317, MECE 6318, MECE 6319, MECE 6320, MECE 6321, MECE 6322, MECE 6323, MECE 6324, MECE 6325, MECE 6326, MECE 6327, MECE 6328, MECE 6329, MECE 6362, MECE 6399.

- **Thermal-Fluid Sciences**
  Choose four, three-unit courses from the following list:
  MECE 6310, MECE 6341, MECE 6362, MECE 6372, MECE 6373, MECE 6375, MECE 6379, MECE 6380, MECE 6384, MECE 6385, MECE 6399.

U.S. Citizenship and Immigration Services Considerations

Mexican nationals who will be living in Mexico while studying at UT Pan American are considered border commuter students. Border commuter students can apply for a student visa to study part-time at UTPA. However, international students, including Mexican nationals, who will be living in the United States while studying, can only apply for a student visa to study full-time at UTPA (at least nine credits per semester). For more information on International Graduate Applications, please visit www.utpa.edu/gradschool.

ACADEMIC DISHONESTY

Any evidence of academic dishonesty, cheating, or plagiarism will result in **loss of credit** for the work, and will be reported to the Chair of the ME Department and the Dean of Students for appropriate action which may include **loss of credit** for the course or **dismissal** from the University. The UTPA Student Conduct Code on scholastic dishonesty is detailed in section 5.5.2 of the Handbook of Operating Procedures.

COURSE DESCRIPTIONS

- **MECE 6190 | Engineering Seminar:** This one hour seminar course is geared toward helping graduate students develop and improve their oral presentation skills and provide them with technical expertise in their field of study. The class will feature engineering presentations prepared by faculty and graduate students from various engineering disciplines and backgrounds. Students enrolled in this class will gain great oral presentation experience by presenting their work in front of an audience and by learning from other featured speakers. The experience gained from this seminar course will prove invaluable for students in their future careers. Prerequisite: Graduate standing in engineering.

- **MECE 6310 | Intermediate Engineering Analysis:** Topics include Vector Algebra, Coordinate Systems, Vector Differential Calculus, Vector Integral Calculus, Tensor Analysis and Applications, Calculus of Variations, and Variational Analysis. Prerequisite: Graduate standing in engineering.

- **MECE 6317 | Corrosion Engineering:** The corrosion phenomena are complex due to the coexistence of electrochemical, metallurgical, biological and environmental parameters which can act at the surfaces. The Corrosion Engineering course will provide an understanding of the mechanisms of corrosion, characterization of the process, protection by coatings and lifetime prediction. The fundamentals of thermodynamics and kinetic concepts will be used to describe destructive chemical interactions of materials with their environment. Particular emphasis will be placed on the identification and solution of practical corrosion problems in real engineering situations. Prerequisite: Graduate standing in engineering.

- **MECE 6319 | Thin Films and Surface Engineering:** Techniques and processes of thin film deposition and surface treatment; Vacuum science and technology; Fundamental processes occurring during thin film deposition (adsorption, surface diffusion, nucleation, and microstructure development); Major thin film deposition processes: evaporation, sputtering, chemical and the coating systems; Testing, characterization and applications of novel thin films (precision mechanical engineering, electronic devices, medical devices, aerospace industries). Prerequisite: Graduate standing in engineering.

- **MECE 6320 | Fracture Mechanics:** Development of the tools of linear and nonlinear fracture mechanics with coverage of theoretical considerations. The primary focus of the course is applications of tools to solution of practical problems in fracture prediction and failure analysis. Significant attention is paid to the phenomenology of fracture in metals, polymers, ceramics and composites. Prerequisite: Graduate standing in engineering.

- **MECE 6321 | Intermediate Composite Material Design:** An introduction to the theory of mechanics of solids for elastic and viscoelastic composite materials. Emphasis on analysis and design of structural laminate composite including failure mechanism, e.g., fatigue, delamination and dynamics of composites including effective moduli and material damping. Prerequisite: Graduate standing in engineering.

- **MECE 6322 | Ceramic Materials Engineering:** A survey of the fundamental properties of ceramic and glass materials which are utilized in electronic, electro-optic, thermal, and mechanical systems. Includes an introduction to the manufacturing processes specific to ceramics with an emphasis on their interaction with the design process. Probabilistic design schemes for mechanical components are covered and students perform a detailed component or process design. Several laboratory demonstrations and assignments are included. Prerequisite: Graduate standing in engineering.

- **MECE 6323 | Polymer Processing:** Course designed to provide fundamental understanding of polymer processing techniques. The course presents information that relates the thermo-physical, mechanical and rheological properties of polymeric materials with particular processing techniques. Manufacturing polymer processes such as mixing, extrusion, injection molding, calendering, fiber spinning, and processes related to nanoreinforced polymer fabrication are studied. Prerequisite: Graduate standing in engineering.

- **MECE 6324 | Viscoelasticity Theory:** Introduction to the mathematical theory of linear viscoelasticity with a focus on solution of real problems. Coverage of transform techniques, numerical models, design of viscoelastic components, and experimental determination of viscoelastic constitutive relations. Prerequisite: Graduate standing in engineering.

- **MECE 6325 | Composite Structures Engineering:** The course is devoted to the theory and/or analysis of composite materials (i.e. composite laminates) and structures in particular. The principles and methods for the analysis and design of structural components, from micromechanics through macromechanics to structural analysis, are presented along with a discussion of how these theories may be used in practical design problems. Prerequisite: Graduate standing in engineering.

- **MECE 6326 | Polymer Engineering:** Introductory course designed to provide a polymer materials science background to engineering students that will enable them to design polymer components. Prerequisite: Graduate standing in engineering.

- **MECE 6327 | Intermediate Nanotechnology:** Course designed to introduce fundamental nanotechnology and nanoscience aspects as well as to study a variety of technologies and potential applications that fall under the nanotech umbrella. The nanotechnology revolution provides an opportunity for the students to foster creative thinking given the vast potential in the area. Prerequisite: Graduate standing in engineering.

- **MECE 6328 | Spectroscopic Techniques:** Course designed to introduce students to spectroscopic techniques used in the identification of organic compounds. Techniques such as mass spectrometry, infrared, wave dispersive spectrometry, x-ray photoelectron spectroscopy, and elemental dispersive spectroscopy will be studied. Students will have an opportunity to get practical experience in operating some of the studied techniques. Prerequisite: Graduate standing in engineering.

- **MECE 6329 | Introduction to Laser Material Processing:** This course will introduce the concept of stimulated emission of radiation and its application in practical laser systems. It will demonstrate means for focusing lasers and the control of the energy produced. Additionally, the course will present applications in areas such as welding, marking, surface treatments, forming, and prototyping. Students will learn the use of lasers and their applications in laser materials processing, the principles of laser materials interaction, safety, and new applications of the laser technology to enhance current practices. Prerequisite: Graduate standing in engineering.

- **MECE 6331 | Intermediate Dynamics of Mechanical Systems:** Intermediate dynamics, including Newton-Euler, Lagrange, and Hamilton's principles; gyroscopic effects in mechanical systems; analysis of stability of systems; numerical simulation. Prerequisite: Graduate standing in engineering.

- **MECE 6332 | Intermediate Mechanical Vibrations:** An examination of linear, multi-degree of freedom and continuous vibratory systems, both conservative and non-conservative. Free and forced vibration problems using generalized coordinates are also examined. Prerequisite: Graduate standing in engineering.

- **MECE 6333 | Nonlinear Dynamics and Chaos:** This course covers the essentials of nonlinear dynamics and chaos in mechanical engineering. Topics include: Principles of dynamics, principle of virtual work, Hamilton principle, Lagrange equations, continuous systems applications. Nonlinear models and nonlinear phenomena. One-degree-of-freedom systems, qualitative analysis, equilibrium, stability, limit cycles, bifurcation, chaos, strange attractors and fractals; quantitative analysis, approximate asymptotic techniques; conservative systems, nonconservative systems, forced systems, subharmonic and superharmonic resonances, parametrically excited systems. Finite-degree-of-freedom systems, free oscillations of gyroscopic systems, forced oscillations of quadratic or cubic nonlinear systems, parametrically excited systems. Nonlinear continuous systems, beams, strings, and plates. Experimental nonlinear dynamics and chaotic vibrations. Utilization of MATLAB in mechanical engineering applications related to nonlinear dynamics and chaos. Prerequisite: Graduate standing in engineering.

- **MECE 6334 | Modeling MEMS and NEMS:** This course covers modeling and analysis of microelectromechanical and nanoelectromechanical systems. Topics include: introduction; continuum mechanics: heat conduction, elasticity, linear thermoelasticity, fluid dynamics, electromagnetism, numerical methods; scaling; thermally driven systems; modeling elastic structures: beams, membranes, plates; modeling coupled thermal-elastic systems; modeling electrostatic-elastic systems: membranes, beams, plates; modeling magnetically actuated systems; microfluidics; and nonlinear dynamics of MEMS and NEMS. Prerequisite: Graduate standing in engineering.

- **MECE 6335 | Orthopedic Biomechanics:** This course covers the following topics: loads and motion in the musculoskeletal system; tissue mechanics; structural analysis; bone-implant systems; total hip replacements; total knee replacements; articulating surfaces; introduction to and utilization of computational packages in orthopedic biomechanics; computer aided design of implants; and finite element analysis. Prerequisite: Graduate standing in engineering.

- **MECE 6339 | Tracking Theory and Applications:** This course provides a means of calculating estimates of quantities based on observations of physical systems. The objective of the course is to give the student an understanding of tracking theory and its applications. The course will include a derivation of the equations used in estimation, and a computer-programming project in which the equations will be applied. The computer-programming project will involve a simulated satellite orbit determination problem. Previous course work or knowledge in orbit theory and control theory is not required. Prerequisite: Graduate standing in engineering.

- **MECE 6341 | Modeling of Physical Systems:** This course reviews principles that govern the behavior of dynamic systems and introduces lumped-parameter methods for building mathematical models and simulations of engineering systems. An energetic approach based on bond graph techniques, invented in 1959 by Henry M. Paytner, is introduced and used to model, simulate and analyze mechanical, electrical, magnetic, electromechanical, hydraulic, and thermal systems. Advanced topics include nonlinear mechanics, Lagrange's Equations, and distributed-parameter systems. Prerequisite: Graduate standing in engineering.

- **MECE 6342 | Modern Control Systems:** This course is an introduction to state variable methods for design and analysis of control systems. Concepts including controllability, observability, calculus of variations, linear quadratic regulator, optimal control, Lyapunov stability criteria, and Pontryagin's Minimum Principle are covered for discrete- and continuous-time systems. Prerequisite: MECE 6341 or equivalent.

- **MECE 6343 | Digital Control Systems:** This course presents the theory of digital control systems required to design, simulate, and implement a control strategy using computers and discrete data manipulation. The development of microprocessors, microcontrollers, and digital signal processors allow

taking sampled data measurements of the system output and computing a feedback control signal to make decisions and generate a desired system performance. Digital control systems are highly flexible, can implement complex control strategies, and are easily reprogrammable. Analysis and design tools will be studied for the design of digital controllers. MATLAB/Simulink will be used to design and simulate the digital controllers. Prerequisite: MECE 6341 or equivalent.

- **MECE 6344 | Nonlinear Control Systems:** This course is meant to be an introduction to advanced nonlinear control methods including variable structure systems, feedback linearization, and sliding mode control. It covers methods stability analysis and controller design of nonlinear controls. The course will review such topics as phase-plane analysis and Lyapunov stability criteria, and advanced topics including adaptive control methods. Prerequisite: MECE 6341 or equivalent.

- **MECE 6360 | Advanced Mechanics of Materials:** The topics covered in this course include: theory of elasticity, principles of stress and strain, inelastic material behavior, applications of energy methods, bending and torsion of general cross-sections, curved beams, elastic and inelastic stability of columns, and flat plates. Prerequisite: Graduate standing in engineering.

- **MECE 6362 | Finite Element Analysis:** An introduction to the theory of finite element methods, with application to stress analysis, natural frequency extraction and heat transfer. Strategies for meshing and applying boundary conditions are also examined. Existing codes are used for determining finite element solutions. Prerequisite: Graduate standing in engineering.

- **MECE 6372 | Viscous Flow I:** Course is aimed towards familiarizing the student with the properties of a fluid, viscous-flow phenomena, and the fundamental equations of compressible viscous flow, such as the conservation of mass and momentum equations and the energy equation. Solutions to some of the most common Newtonian viscous-flow equations, such as the Couette and Poiseuille flows, and some unsteady duct flows, will also be explained. Laminar boundary layers will be studied in detail. Prerequisite: Graduate standing in engineering.

- **MECE 6373 | Viscous Flow II:** This course is a continuation of MECE 6372 Viscous Flow I. Coverage begins with a detailed study of laminar boundary layers, a select few boundary-layer solutions and two finite-difference approaches will be presented. Stability theory and the latest engineering predictions of laminar to turbulent transition will be examined. Incompressible turbulent mean flow and turbulence modeling will be explored. Prerequisite: MECE 6372 or equivalent.

- **MECE 6375 | Engineering Acoustics:** The course is designed to develop an understanding of the fundamentals of acoustics, such as traveling waves in one- and two-dimensions, the derivation and nature of the fundamental fluid acoustic equations, the phenomena associated with reflection, transmission, radiation, reception, absorption, and attenuation of sound, and the phenomena associated with cavities and waveguides, including sound propagation in pipes, resonators, and filters. Prerequisite: Graduate standing in engineering.

- **MECE 6379 | Gas Dynamics:** This course is designed to provide a fundamental understanding and a cohesive picture of compressible flow from a modern perspective which is a supportive mixture of classical analysis along with computational techniques. This course covers the basics of one-dimensional compressible flow, integral forms of conservation equations for inviscid flow, shocks and expansion waves, unsteady wave motion and linearized flow. Prerequisite: Graduate standing in engineering.

- **MECE 6380 | Combustion Engineering:** The topics covered in this course include: role of combustion in energy, environment and fire problems, thermodynamics of combustion (thermochemistry), fuels (gas, liquid and solid), chemical kinetics, combustion of gaseous and vaporized

fuels (flames), combustion of liquid fuels, combustion of solid fuels, pollutant emissions, and modern measurements. Prerequisite: Graduate standing in engineering.

- **MECE 6384 | HVAC System Design:** Heating, ventilating, air conditioning, and refrigeration are specific applications of the principles of thermodynamics, heat transfer, and fluid mechanics to the design and analysis of systems that maintain the environmental conditions of controlled space. An emphasis is placed on the practical application of principles to the design and analysis of HVAC systems in buildings and the use of HVAC software. Prerequisite: Graduate standing in engineering.

- **MECE 6385 | Thermal Systems:** Modeling and simulating the steady-state and dynamic thermal behavior of components and systems; advanced modeling of properties; and optimization applied to the design of thermal systems. Prerequisite: Graduate standing in engineering.

- **MECE 6397 | Master's Report I:** Preparation of a report to fulfill the requirements for the master's degree under the report option. The equivalent of three lecture hours a week for one semester. Offered on the letter grade basis only. Prerequisites: Graduate standing in mechanical engineering and consent of the graduate adviser.

- **MECE 6398 | Master's Report II:** Preparation of a report to fulfill the requirements for the master's degree under the report option. The equivalent of three lecture hours a week for one semester. Offered on the letter grade basis only. Prerequisites: Graduate standing in mechanical engineering and consent of the graduate adviser.

- **MECE 6399 | Topics in Mechanical Engineering:** In-depth study of specific areas in mechanical engineering. Subject matter varies from semester to semester. May be repeated for credit when subject matter changes. Prerequisites: Graduate standing in engineering.

- **MECE 7300 | Master's Thesis I:** Preparation of a thesis to fulfill the requirement for the master's degree under the thesis option. The equivalent of three lecture hours a week for one semester. Offered on a letter grade basis only. Prerequisites: Graduate standing in mechanical engineering and consent of the graduate adviser.

- **MECE 7301 | Master's Thesis II:** Preparation of a thesis to fulfill the requirement for the master's degree under the thesis option. The equivalent of three lecture hours a week for one semester. Offered on a letter grade basis only. Prerequisites: Graduate standing in mechanical engineering and consent of the graduate adviser.

CHECKLIST SUMMARY TABLE

Task Description	Task Deadline		
	Thesis Option	Project with Report Option	Coursework Option
Preparation of an initial plan of study	First semester of graduate work	First semester of graduate work	First semester of graduate work
Preparation of a final plan of study	No later than the second semester of graduate work	No later than the second semester of graduate work	Within two semesters of the graduation date
Formation of the Graduate Committee	No later than the second semester of graduate work	No later than the second semester of graduate work	N/A
Submittal of Thesis/Project proposal to Graduate Committee	Prior to registering for the first Master's Thesis course	Prior to registering for the first Master's Report course	N/A
Application for Graduation	Nine months prior to the expected graduation date	Nine months prior to the expected graduation date	Nine months prior to the expected graduation date
Written comprehensive exit examination*	N/A	N/A	Upon completion of the four required courses but within the final two semesters of graduate work (Fall/Spring only)
Oral comprehensive exit examination	Thesis defense should be scheduled no later than two weeks prior to the end of the student's final semester	Project defense should be scheduled no later than two weeks prior to the end of the student's final semester	Within the final two semesters of graduate work (Fall/Spring only)
Scheduling of Thesis/Project defense or Exit Examination	At least four weeks prior to Thesis defense	At least four weeks prior to Project defense	One semester in advance
Thesis/Project defense advertisement	At least one week prior to the Thesis defense	At least one week prior to the Project defense	N/A
Submittal of the Thesis/Project Report to the Graduate Committee	At least one week prior to the Thesis defense	At least one week prior to the Project defense	N/A
Submittal of the final Thesis/Project Report to the Graduate Office	No later than Monday of final exam week	No later than Monday of final exam week	N/A

* The written comprehensive examination will be held on the Friday two weeks before the end of the Fall and Spring semesters.

ACKNOWLEDGEMENT OF RECEIPT

By signing below, I hereby affirm that I have received a copy of the **Mechanical Engineering Graduate Program Handbook**, and have been informed by the **Graduate Program Director** that it is my responsibility to **carefully** read and understand this document and adhere to all the rules, regulations, deadlines, and requirements described herein. Failure to do so can result in delays to my time to graduation.

_____

Student ID Number

_____

Printed Name

_____

Signature

_____

Date