PRINCE MOHAMMAD BIN FAHD UNIVERSITY

CREATIVE MINDS, TRANSFORM THE WORLD

Graduate Student Handbook

Department of Mechanical Engineering
Prince Mohammad Bin Fahd University

December 2024

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I. INTRODUCTION

Welcome to the graduate program in Mechanical Engineering (ME) at PMU. You have embarked on an exciting journey. Advanced engineering study is intellectually stimulating and will prove to be a great asset in your career.

This handbook is prepared to help you navigate through program and degree requirements and provide you with additional information that will help you to be successful in your studies.

In addition to this handbook, useful information may be found on the following web sites:

- PMU admission office; (https://www.pmu.edu.sa/admission/admissions_requirements_msme_gdp)
- Department of Mechanical Engineering (https://pmu.edu.sa/academics/msme)

Note that the purpose of the Graduate Handbook is to give you a brief outline of various procedures and requirements needed to attain a graduate degree; however, the Mechanical Engineering Department sites are the definitive resources for graduate procedures and policies. Note that in all cases, information on the PMU web site take precedent over the information provided in this document.

When questions arise, you should first consult your major advisor. Your advisor is your primary advocate. The Mechanical Engineering Department will be happy to help with any questions that your advisor cannot answer.

II. ADMISSION REQUIREMENTS

***MSME*:** For unconditional admission to the MSME Program, a prospective graduate student should have:

- Bachelor's degree in mechanical engineering or related field (Appendix A lists requirements for those with non-ME degrees),
- GPA of at least 2.75 on a 4.0 scale, and
- Interview with the department.

A short Statement of Purpose describing possible research/study interests and a Resume are also required. External applicants should submit three letters of recommendation. All applicants must submit ILETS/TOEFL scores of 6.0/580 or higher.

Doctorate: For admission to the Doctorate Program, a prospective graduate student should have:

- Master's degree in Mechanical Engineering,
- Grade point average of at least 3.0 on a 4.0 scale
- Interview with the department.

A short Statement of Purpose describing possible research/study interests and a Resume are required for each application. External applicants should also submit three letters of recommendation.

All applicants must submit ILETS/TOEFL scores of 6.0/580 or higher.

III. DEADLINES

There are no formal deadlines for graduate applications. Once an application is complete, the internal review process typically only takes a few days. However, **international applicants** should consider the time required to obtain any necessary travel documents. Only after the student has been accepted and the University has provided the appropriate paperwork can an applicant then apply with their country of origin for these travel documents. Some countries take between two and six months, depending on the country of origin, to then provide the appropriate travel documents. Students must complete this process and arrive on campus prior to the first day of class. All of these steps should be considered by international students when planning to apply.

IV. GENERAL INFORMATION

A. Prince Mohammad Bin Fahad University

Prince Mohammad Bin Fahd University (PMU) is a new private university in the Eastern Province of Saudi Arabia, which started its classes in 2006. The University has an outstanding academic reputation. It is ranked *4th* in Arab university ranking by *THE, 24 by QS Arab Region Ranking and 751-800 by QS World University Ranking*. The current enrollment is over 5,000 students with approximately 200 of those in graduate programs and around 1600 students enrolled in an engineering degree program.

B. The Department of Mechanical Engineering

Approximately 1,000 undergraduates and more than 18 graduate students are enrolled in mechanical engineering at PMU. Currently, there are over 30 mechanical engineering faculty members. The department has active research area in, ThermoFluids Science (TFS), and Materials Processing & Manufacturing (MPM). Faculty teach under graduate and graduate-level courses, conduct research in the areas that include: automotive systems, energy and building efficiency, internal combustion engines, manufacturing systems, additive manufacturing, and materials processing and modeling. Graduate courses in these areas, in addition to the general core graduate courses, provide the

foundation for earning a Master of Science (MSME) or Doctoral (PhD) degree in mechanical engineering. The department offers Mechanical Systems and ThermoFluids track master's degree for the student. Individual faculty members and their research and teaching interests are listed on the ME website, https://pmu.edu.sa/academics/mechanical_engineering_dept_coe_udp

Students and faculty in the Department of Mechanical Engineering have access to state of the art computational facilities and capabilities. On-campus assets include numerous commercially available computational modeling software packages through the College of Engineering.

C. Assistantships, Financial Aid, and Fellowships

Many unconditionally admitted full-time graduate students seek and receive some form of financial assistance in the form of a graduate assistantship. Assistantships generally include a monthly stipend and tuition fees.

Graduate Research Assistantships (GRAs) to be included later.

The ME Department offers Graduate Teaching Assistantships (GTAs) for students assisting faculty members with undergraduate courses and laboratories. GTA awards are determined by the ME Department Chair. There are a very limited number of GTA positions each semester.

Students may be eligible for student loans and other financial aid and should visit the PMU Financial Aid Office to learn more about these options. Additional support is may be available in the form of fellowships, available from the University and other funding agencies.

D. Graduate Courses

Graduate courses are those with numbers in the 600-level. 600-level courses are associated with MSME-level and PhD-level work. Both MSME and PhD plans of study can contain both 600- level courses. Graduate courses are listed in the

(Department of Mechanical Engineering (https://pmu.edu.sa/academics/msme)

Required courses can be repeated for credit if the student makes a D or F grade with the recommendation of the Department Chair and the Dean of the college.

Note that 400-level courses are generally not acceptable for graduate degree requirements.

E. Academic Misconduct

It is important that students have a clear understanding of what level of group activity is allowable for each assignment. Students should be careful to cite references properly

whenever the literature, web, or any work of others is used. Penalties for academic misconduct can range from a grade of zero on the particular assignment to expulsion from the University.

> "Academic misconduct includes all acts of dishonesty in any academic or related matter and any knowing or intentional help, attempt to help, or conspiracy to help, another student commit an act of academic dishonesty. Academic dishonesty includes, but is not limited to, the following acts, when performed in any type of academic or academically related matter, exercise, or activity:
>
> - **Cheating**: using or attempting to use unauthorized materials, information, study aids, or computer-related information
> - **Plagiarism**: representing the words, data, works, ideas, computer programs or output, or anything not generated in an authorized fashion, as one's own
> - **Fabrication**: presenting as genuine any invented or falsified citation or material
> - **Misrepresentation**: falsifying, altering, or misstating the contents of documents or other materials related to academic matters, including schedules, prerequisites, and transcripts

F. Grades and Academic Standing

Grades in graduate courses are assigned on the A, B, C, D, F system. Plus grades are also used for graduate courses. A weighted grade point average (GPA) is computed using 4 points for A's, 3 for B's, 2 for C's, 1 for D's and 0 for F's. In order to be in good academic standing and to graduate, a student must maintain at least a B average (GPA ≥ 3.0). Graduate students with 12 or more credit hours and a GPA < 3.0 will be placed on academic warning. To remain in the program, students on academic warning must raise their GPA to 3.0 or better by the end of the semester following being placed on academic warning.

G. Email and Departmental Mailboxes

Each PMU student will be assigned a mailbox account on the University web portal. This portal includes an email address yourid@pmu.edu.sa." This crimson e-mail account is the official communication channel between you, The University, and the ME Department. You should check your account every day for official announcements, summons, and classroom communications. The student will be held responsible for official communications sent to this email account.

H. Assessment of the Department's Graduate Program

The Mechanical Engineering Department has implemented an annual graduate programs assessment plan required by NCAAA/ABET accreditation agency and Deanship of quality and accreditation. For this assessment, each faculty who is teaching graduate

course has to prepare a Course Portfolio to present to the department.

I. Seminar

The ME department holds a seminar series in each regular academic term. In addition to student presentations, outside speakers distinguished in some area of engineering are invited to make seminar presentations. Graduate students are expected to attend these seminars. There is a one-hour course that students may take to obtain course credit for this seminar series each semester.

V. REQUIREMENTS FOR THE MSME DEGREE PROGRAM

A. Degree Requirements

The Master of Science in Mechanical Engineering (MSME) degree may be obtained through either of two Tracks.

MSME – MECHANICAL SYSTEMS TRACK: 30 Credit Hours

- The mechanical system track option is the standard master's degree for mechanical engineering. Graduates complete 24 hours of graduate course work (600-level), and a thesis.
- The thesis must be approved by the advisory committee. The student must pass a final presentation and defense of the thesis, also they must publish/accept an article in an international SCOPUS index conference.

MASTER OF SCIENCE IN MECHANICAL ENGINEERING (MSME)
MECHANICAL SYSTEMS TRACK

Total Credit Hours : 30

FIRST YEAR					
FIRST SEMESTER			SECOND SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
GEEN 6301	Applied Mathematics for Engineers	3	GEEN 6304	Interdisciplinary Research and Seminar	3
GEEN 6303	Design of Experiments	3	MEEN XXXX	MSME Elective	3
GEEN 6302	Computer Aided Engineering	3	MEEN XXXX	MSME Elective	3
Total Credit Hours		**9**	Total Credit Hours		**9**

SECOND YEAR					
THIRD SEMESTER			FOURTH SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
MEEN XXXX	MSME Elective	3	MEEN 6699	Thesis	6
MEEN XXXX	MSME Elective	3			
Total Credit Hours		**6**	Total Credit Hours		**6**

MSME Electives Courses Mechanical Systems Track	
MEEN 6341: Experimental Mechanics	MEEN 6352: Non-Destructive Testing and Evaluation
MEEN 6342: Mechanical Vibration	MEEN 6353: Tribology
MEEN 6343: Finite Element Analysis	MEEN 6354: Reverse Engineering and Rapid Prototyping
MEEN 6344: Digital Control Systems	MEEN 6355: Additive Manufacturing
MEEN 6345: Advanced Systems Dynamics and Control	MEEN 6356: Advance Material Characterizations
MEEN 6346: Advanced Dynamics of Mechanical Systems	MEEN 6357: Laser Material Processing
MEEN 6347: Mechanics of Materials	MEEN 6358: Industry 4.0 and Digital Manufacturing
MEEN 6348: Engineering Materials	MEEN 6359: Polymer Engineering
MEEN 6349: Advanced Corrosion Analysis	MEEN 6371: Special Topics in Mechanical Engineering
MEEN 6350: Advanced Manufacturing Processes	MEEN 6372: Special Topics in Mechanical Engineering
MEEN 6351: Fracture Mechanics	

MSME – THERMOFLUIDS TRACK: 30 Credit Hours

- The thermofluid track option is the standard master's degree for mechanical engineering. Graduates complete 24 hours of graduate course work (600-level), and a thesis.
- The thesis must be approved by the advisory committee. The student must pass a final presentation and defense of the thesis, also they must publish/accept an article in an international SCOPUS index conference.

MASTER OF SCIENCE IN MECHANICAL ENGINEERING (MSME)
THERMOFLUIDS TRACK

Total Credit Hours : 30

FIRST YEAR					
FIRST SEMESTER			SECOND SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
GEEN 6301	Applied Mathematics for Engineers	3	GEEN 6304	Interdisciplinary Research and Seminar	3
MEEN 6303	Design of Experiments	3	MEEN XXXX	MSME Elective	3
MEEN 6302	Computer Aided Engineering	3	MEEN XXXX	MSME Elective	3
Total Credit Hours		**9**	Total Credit Hours		**9**

SECOND YEAR					
THIRD SEMESTER			FOURTH SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
MEEN XXXX	MSME Elective	3	MEEN 6399	Thesis	6
MEEN XXXX	MSME Elective	3			
Total Credit Hours		**6**	Total Credit Hours		**6**

MSME Electives Courses Thermofluids Track	
MEEN 6311: Advanced Fluid Mechanics	MEEN 6319: Energy Conservation
MEEN 6312: Advanced Heat Transfer	MEEN 6320: Advanced Turbo-Machinery
MEEN 6313: Computational Fluid Dynamics	MEEN 6321: Desalination
MEEN 6314: Design of Heating Ventilation and Air Conditioning Systems	MEEN 6322: Advance Gas Dynamics
MEEN 6315: Gas Turbines Technology	MEEN 6323: Simulation and optimization of Mechanical Systems
MEEN 6316: Thermal Power Plants	MEEN 6324: Advanced Mathematical and Numerical Methods
MEEN 6317: Renewable Energy Technology	MEEN 6371: Special Topics in Mechanical Engineering
MEEN 6318: Advanced Thermodynamics	MEEN 6372: Special Topics in Mechanical Engineering

B. Transfer Credit

With the department approval, students may transfer up to 6 hours. It is recommended that you discuss potential transfer courses with the ME department. Note that the department has very strict deadlines regarding the transfer of credit that differ from graduation application deadlines.

C. Thesis

The thesis is a formal research document and must be prepared as per department guidelines. Your thesis will be reviewed by your thesis advisors. Once he/they are satisfied with the thesis, you and your thesis advisor will schedule your Thesis Defense. After successfully defending your thesis, you may have final corrections and revisions to your thesis before the committee gives their final approval. Such conditions should be considered in scheduling the presentation/defense relative to the department submission deadlines.

D. Time Limits

All requirements for the MSME degree must be completed during the six years prior to the date that the degree is awarded.

VI. REQUIREMENTS FOR THE DOCTORATE DEGREE PROGRAM

A. Degree Requirements

The doctorate requires 36 credit hours of coursework past the Bachelor's degree, a comprehensive qualifying exam, and a dissertation research (60 credit hours). The dissertation requirements will include a proposal, proposal defense, dissertation report, and dissertation defense. The dissertation must sufficiently document original research that makes a significant contribution to the profession. Students with a Master's degree will receive credit for 24 hours of course work.

- Four*/Eight** elective courses (600 level)
- Mathematics for PhD Students (non-credit)
- The Academic Advisor may request the completion of additional courses.
- Comprehensive Exam***
- Dissertation Proposal Defense****
- Teaching Internship*****
- A dissertation reviewed and approved by the committee members. The candidate will defend a dissertation in a formal manner for this committee. The dissertation requirements will include a proposal, proposal defense, dissertation report, and dissertation defense. The dissertation must sufficiently document original research that makes a significant contribution to the profession******

*Candidate with a master degree in mechanical engineering requires to complete four courses at the 600 level.
**Candidate with a master degree in other engineering discipline requires to complete eight courses at the 600 level.

***Students are required to complete their comprehensive exam after successful passing their course work no later than the end of third semester.

****Students are required to complete their oral defense of the dissertation proposal on the fourth semester.

*****Students are required to teach 2 courses on their final year

****** The dissertation defense is the final exam of the Doctorate in Mechanical Engineering degree. The result of the defense will be made based on the recommendation of the committee. There are four possible results:
(1) Pass: the student passes the exam and the dissertation is accepted as submitted;
(2) Pass with minor revisions: the student passes the exam and the student is advised of the revisions that must be made to the text of the dissertation;
(3) Pass with major revisions: the student passes the exam and the student is advised of the revisions that must be made the dissertation within six months from the date of the first defense;
(4) Failure with retake: normally this means the student must do more research to

complete the dissertation. The student must revise the dissertation and give another oral examination within six months from the date of the first defense
(5) Failure: the student does not pass the exam, the dissertation is not accepted, the degree is not awarded, and the student is dismissed from the University.

Candidacy
Achieving candidacy is contingent upon successfully passing a qualifying examination, acceptance of a written research proposal, and successfully passing an oral defense examination.

DOCTORATE – MECHANICAL ENGNERRING

DOCTORATE IN MECHANICAL ENGINEERING **Total Credit Hours : 72**					
FIRST YEAR – LEVEL 1					
FIRST SEMESTER			SECOND SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
MEEN XXXX	Elective	3	MEEN XXXX	Elective	3
MEEN XXXX	Elective	3	MEEN XXXX	Elective	3
MEEN 7000	Dissertation	6	MEEN 7000	Dissertation	6
Total Credit Hours		**12**	Total Credit Hours		**12**

SECOND YEAR - LEVEL 2					
THIRD SEMESTER			FOURTH SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
MEEN 7001	Dissertation (Comprehensive Exam)	12	MEEN 7001	Dissertation (Dissertation Proposal Defense)	12
Total Credit Hours		**12**	Total Credit Hours		**12**

THIRD YEAR - LEVEL 3					
FIFTH SEMESTER			SIXT SEMESTER		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
MEEN 7001	Dissertation	12	MEEN 7001	Dissertation	12
Total Credit Hours		**12**	Total Credit Hours		**12**

Electives Courses	
MEEN 6311: Advanced Fluid Mechanics	MEEN 6341: Experimental Mechanics
MEEN 6312: Advanced Heat Transfer	MEEN 6342: Mechanical Vibration
MEEN 6313: Computational Fluid Dynamics	MEEN 6343: Finite Element Analysis
MEEN 6314: Design of Heating Ventilation and Air Conditioning Systems	MEEN 6344: Digital Control Systems
MEEN 6315: Gas Turbines Technology	MEEN 6345: Advanced Systems Dynamics and Control
MEEN 6316: Thermal Power Plants	MEEN 6346: Advanced Dynamics of Mechanical Systems
MEEN 6317: Renewable Energy Technology	MEEN 6347: Mechanics of Materials
MEEN 6318: Advanced Thermodynamics	MEEN 6348: Engineering Materials
MEEN 6319: Energy Conservation	MEEN 6349: Advanced Corrosion Analysis
MEEN 6320: Advanced Turbo-Machinery	MEEN 6350: Advanced Manufacturing Processes
MEEN 6321: Desalination	MEEN 6351: Fracture Mechanics
MEEN 6322: Advance Gas Dynamics	MEEN 6352: Non-Destructive Testing and Evaluation
MEEN 6323: Simulation and optimization of Mechanical Systems	MEEN 6353: Tribology
MEEN 6324: Advanced Mathematical and Numerical Methods	MEEN 6354: Reverse Engineering and Rapid Prototyping
MEEN 6371: Special Topics in Mechanical Engineering	MEEN 6355: Additive Manufacturing
MEEN 6372: Special Topics in Mechanical Engineering	MEEN 6356: Advance Material Characterizations
MEEN 6373: Special Topics in Mechanical Engineering	MEEN 6357: Laser Material Processing
MEEN 6374: Special Topics in Mechanical Engineering	MEEN 6358: Industry 4.0 and Digital Manufacturing
MEEN 6375: Special Topics in Mechanical Engineering	MEEN 6359: Polymer Engineering

B.

C. Committees

Every Doctorate candidate is responsible for working with his/her advisor and the committee of three or more members. The candidate's committee will consist of the advisor plus at least two members of the department's faculty (one faculty member from outside the department may be accepted with the department approval). The committee will work with the advisor to evaluate the candidate's dissertation and plan the dissertation defense, as well as to help the candidate with any problems that may arise in the course of obtaining the PhD degree.

D. Plan of Study

Soon after admission to the Doctorate program, you should work with your advisor and committee to complete the Outline of Doctoral Program. Consult the graduate course schedule for help with choosing the coursework that will be listed in this 3-year plan of study. Courses listed in the plan of study may be modified during your course of study with the approval of your advisor. **It is the student's responsibility to keep the graduate school informed of revisions to the Plan of Study, as this document is used to audit the student's courses prior to graduation**.

E. Residence Requirements

In addition to completing the graduate coursework, all of the dissertation research hours must be earned while attending PMU.

F. Dissertation Research Proposal

The Ph.D. degree is a research degree whose defining elements are the dissertation research and dissertation. A formal written dissertation research proposal is an important part of the Comprehensive Qualifying Examination discussed in section F.

G. Comprehensive Qualifying Examination

A comprehensive qualifying examination is required of all students enrolled in the doctoral program for earning PhD candidacy. This examination is given after approximately one and half full years of graduate study are completed. The examination consists of the following:

- An examination, oral or written, based on graduate coursework is assigned by the department.
- A written dissertation proposal that describes the research objective and research already completed as well as an outline of the research to be undertaken to complete the dissertation. The specific format is at the discretion of the faculty advisor and dissertation committee.
- An oral examination defending the dissertation proposal.
- Publication of 2 ISI indexed publications

The comprehensive qualifying examination should be completed at least nine months before the degree is to be awarded. If the student's qualifying examination results are deemed unacceptable by the committee, the student may arrange to retake the exam a maximum of one more time. Note also that the proposal/qualifying exam and dissertation defense cannot occur within the same semester.

H. Candidacy and Continuous Registration

A student who has successfully completed the qualifying examinations and has had a dissertation research proposal approved will be admitted to *candidacy* for the doctoral degree. Students admitted to candidacy are expected to pursue completion of the dissertation without interruption by enrolling each semester. **There is a continuous registration requirement.**

I. Dissertation and Final Examination

The dissertation research and dissertation are the defining elements of the PhD degree. The dissertation must demonstrate independent, original scholarship within the mechanical engineering field.
The dissertation is a formal research document and must be prepared following the department guidelines. Your dissertation will be reviewed by your advisor and your dissertation committee. Your advisor will help in scheduling your Final Exam/Dissertation Defense. After a successful defense, you may still have final dissertation corrections and revisions required by the committee. Such conditions should be considered in scheduling the presentation/defense relative to the graduate school submission deadlines.

J. Time Limits

All requirements for the Ph.D. degree must be completed during the nine years immediately prior the date that the degree is awarded.

APPENDICES

A. Undergraduate Course Requirements for Non-ME Graduates

Applicants who hold a Bachelor of Science degree in a discipline other than Mechanical Engineering are encouraged to consider a graduate degree in ME. The following prerequisite undergraduate courses or acceptable equivalents are required

1. Mathematics: Calculus (usually 12 semester credit hours) and Ordinary Differential Equations
2. Chemistry: General Chemistry (usually 4 semester credit hours)
3. Physics: Calculus-Based Physics (usually 8 semester credit hours)
4. Mechanical Engineering, depending on your emphasis area in graduate school
    a. Thermal-Fluids Emphasis:
    ME 215 (3 hours) Thermodynamics
    AEM 311 (3 hours) Fluid Mechanics
    ME 309 (3 hours) Heat Transfer

    or

    b. Mechanical Systems Emphasis
    AEM 250 (3 hours) Mechanics of Materials I
    ME 350 (3 hours) Static Machine Components
    ME 372 (3 hours) Dynamic Systems

The engineering courses listed above may have prerequisite courses as listed in the University Catalog. Students with Bachelor of Science degrees in physical sciences are likely to have the background to start directly in the listed Mechanical Engineering courses. Depending on the number of courses needed from the list above, it may be possible to take one or more of these courses simultaneously with graduate coursework.

Course Catalog

GEEN 6301: Applied Mathematics for Engineers (3, 0, 3):

Fourier Analysis and Partial differential equations: separation of variables and Laplace transforms, The heat equation, Laplace equation, and wave equation. Complex Numbers and Functions, Complex Integration, Power Series, Taylor Series, Laurant Series and Residue Integration, Complex Analysis to Potential Theory.

MEEN 6302: Computer Aided Engineering (2, 3, 3):

Fundamental of design process, stress analysis, thermal and fluid flow analysis, concurrent engineering, geometric modeling, parametric modeling, visualization techniques in engineering, optimization of the product or process. A widely used proprietary design packages is to be used for system simulation and design (ANSYS).

MEEN 6303: Design of Experiments (2, 3, 3):

Introduction to industrial experimentation, fundaments of design of experiments, understanding key interactions, mean effect plots, interaction plots, full factorial design, error and variance, partial factorial design, basic statistical measurements and their application in engineering, statistical analysis of data. The main course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions, mini project.

GEEN 6304: Research Methodology and Seminar (3, 0, 3):

Emphasis on research and writing strategies in proposing and completing an evidence-based academic paper. Drafting and revising thesis statements, literature reviews, sources citation in text. Selection of an appropriate research approach, and constructing a reference list in compliance with international manual style for students and researchers. The use of library in both traditional and electronic methods of finding and making use of evidence. The background and foundations for writing the capstone proposal are provided.

MEEN 6311: Advanced Fluid Mechanics 3 (3, 0, 3):

This course is a survey of principal concepts and methods of fluid dynamics. Topics include Conservation laws; Navier-Stokes equation for viscous flows; similarity and dimensional analysis; boundary layers and flow separation; circulation and vorticity theorems; potential flow; introduction to turbulence in pipes and on a flat plate.

MEEN 6312: Advanced Heat Transfer (3, 0, 3):

This course consists of the following topics, 1D and 2D conduction and applications, transient conduction, thermal boundary layers-free and forced convection, boiling and condensation, pool boiling, two phase flow, laminar and turbulent film condensation, heat exchangers: types, analysis

and design procedure, thermal radiation processes and properties, blackbody radiation, gray surfaces.

MEEN 6313: Computational Fluid Dynamics (2, 3, 3):

Introduction to the methods and analysis techniques used in computational solutions of fluid mechanics and heat transfer problems. Finite difference method, partial differential equations, discretization approaches, stability, consistency, and convergence. Finite-volume formulations, explicit and implicit methods, code and solution verification. A widely used proprietary design package is to be used for system simulation and design (ANSYS/Fluent commercial CFD code).

MEEN 6314: Design of Heating Ventilation and Air Conditioning Systems (2, 3, 3):

HVAC design process, occupant comfort and health, load calculations, HVAC components, all-air HVAC systems, air-and-water systems, all-water systems, special HVAC systems: desiccant systems, thermal storage, energy-efficient subsystems, HVAC&R controls. A widely used proprietary design package is to be used for system simulation and design.

MEEN 6315: Gas Turbines Technology (2, 3, 3):

Gas turbine engine and component performance; gas turbine thermodynamic cycles; combustors fuels and emissions; gas turbine applications and implications to the user; gas turbine control system; gas turbine maintenance strategies; reliability and availability; gas turbine procurement; condition monitoring; usage and retention.

MEEN 6316: Thermal Power Plants (3, 0, 3):

Forms of energy; oil, gas and coal; combustion processes; gas power plants; steam power plants; combined power plants; nuclear power plants; steam generators and their component design; turbines load curves and power plant economy; matching of power plant elements; project: thermal analysis and performance of a power stations.

MEEN 6317: Renewable Energy Technology (3, 0, 3):

Survey of current energy generation, projected demand, political targets, environmental and economic risks, theory of turbines, hydro-energy, wind energy (on-shore/off-shore); fluid mechanics of wind-turbines, solar energy systems, geothermal systems, wave power, tidal streams and tidal barrages. Problems challenging grid placement and dissemination throughout a source network are also studied.

MEEN 6318: Advanced Thermodynamics (3, 0, 3):

First law of thermodynamics; second law of thermodynamics and entropy (review); availability analysis and availability-cycles; multi-component systems; HVAC systems; combustion systems; optimization of systems; thermodynamic design.

MEEN 6319: Energy Conversion (3, 0, 3):

Energy sources and their classification; conventional energy conservation: power plant and vapor cycles; renewable energy: Solar energy with emphasis on solar cells, and wind energy; ocean thermal energy conversion "OTEC" systems; geothermal energy; nuclear fission and types of fission reactors; fuel cells.

MEEN 6320: Turbo-Machinery (3, 0, 3):

Radial flow turbines; axial flow turbines; flow through axial stages; theory of twisted blades; multi-stage turbines; design of the turbine blades; governing of steam and gas turbines; coefficients of performance and design considerations for axial flow compressors and ducted fans; coefficients of performance and design considerations for centrifugal compressors; centrifugal pumps: performance, losses, cavitation, water hammer and impeller design; water turbines; characteristics, design considerations, performance.

MEEN 6321: Desalination (3, 0, 3):

Concepts in thermodynamics; water treatments; fouling and scaling on tubes; fouling removal; thermal desalination: multistage evaporation systems (MES); multistage flash systems (MSF); vapor compression desalination systems(VCD); solar desalination systems; co-generation power systems; reverse osmosis systems: types of membranes; membrane arrangements; energy recovery; back washing; membrane fouling; ultra and nanofiltration.

MEEN 6329: Special Topics in Thermofluid (3, 0, 3):

This course is delivered in light of the advent of new specializations in the field of thermofluid design in addition to the availability of a faculty member in the required specialty. Independent study is part of the course.

MEEN 6341: Experimental Mechanics (2, 3, 3)

Analysis and presentation of experimental data. Displacement measurement and sensors. Signal conditioning and measurement interpretation. Theory and application of strain measurement using electrical resistance strain gages, strain gage circuits. Digital data acquisition systems. Transducer design, calibration and applications. Dynamic measurements. Theory and application of photoelasticity.

MEEN 6342: Mechanical Vibration (2, 3, 3):

This course intended for engineers with background in mechanical, structural or related engineering disciplines Formulation of vibration problems, Free vibrations of Single-Degree-of-Freedom (SDOF) systems, Harmonic forced vibrations of SDOF system, General periodic and non-periodic response, Multi-degree-of-freedom systems, Vibration control techniques, Continuous systems, Vibration measurement.

MEEN 6343: Finite Element Analysis (2, 3, 3):

Basics of Finite Element Method, -Matrix notation, General steps of FEM, Applications of FEM, Advantage and Limitations, Stiffness (Displacement) Method, Stiffness Matrix, Spring Element, Matrix Derivation, Assembly, Shape Functions, Boundary Conditions, Truss Equations, Bar Element, Derivation of Stiffness Matrix, Global Stiffness Matrix, Solution of Plane Truss, Weighted Residual (Galerkin's Residual Method), Shape Functions, Higher Order Shape Functions, Heat Transfer, Basic Differential Equations,

MEEN 6344: Digital Control Systems (2, 3, 3):

Review of the continuous control, introductory digital control, discrete time systems analysis, Sampled-Data Systems, Discrete Equivalents, Design Using Transform Techniques, Design Using State-Space Methods, Case Study: Design of a Disk Drive Servo.

MEEN 6345: Advanced Systems Dynamics and Control (3, 0, 3):

This course introduces the Modeling and Simulation, Linearization, Review of the classical Control Theory, State space representation, Controllability and observability, State feedback and linear quadratic regulator, State observers, Kalman filters, Modeling/performance trad-offs in control system design, Real Application.

MEEN 6346: Advanced Dynamics of Mechanical Systems (3, 0, 3):

This course includes an Introduction to dynamics systems, Fundamental principles, Equations of motion using Newton's laws, Work-energy principle, Simulation of dynamical systems, Kineto-static and time response analysis, Principle of virtual work, Potential energy principle, Lagrange's equations, Hamilton's principle\

MEEN 6347: Mechanics of Materials (3, 0, 3):

Stress & Strain, Stress transformation, principle stress, Plane stress, Mohrs Circle 2D, 3D, Stain theory, transformation, principle strain, Small displacement theory, Stress-Strain-Temperature Relations, Hooke's law: anisotropic, isotropic elasticity, Equ. of thermo-elasticity (isotropic material), Failure Theories, Yield criteria, Yield of Ductile metals, Alternative yield criteria, Energy Methods, Catigliano's theorem on deflection, Deflection of statically determinate structures, Statically indeterminate structures, Torsion, Bending.

MEEN 6348: Engineering Materials (3, 0, 3):

Smart/functional materials, smart/functional materials, high-strength ferrous alloy, high-strength nonferrous alloys, super alloys, high performance polymers, eco-materials, processing-structure-property relationship, damage tolerance, toughening mechanisms structure integrity and reliability.

MEEN 6349: Advanced Corrosion Analysis (3, 0, 3):

This course covers the topics of forms of corrosion, electrochemical mechanisms, thermodynamics and kinetics of corrosion, steel corrosion, corrosion inhibitors, anodic protection, cathodic protection, metallic and organic coatings.

MEEN 6350:Advanced Manufacturing Processes (3, 0, 3):

Rapid Prototyping, Polymer processing / processing of composites, Metal forming, Sheet metal working, Material removal processes, Non-traditional machining, SPC/Lean Manufacturing.

MEEN 6351: Fracture Mechanics (3, 0, 3):

Crack tip solutions, displacements of fracture surfaces, Stress and strain fields and path-independent integrals, Basic tensor algebra, Concepts of dissipated energy, stiffness reduction and compliance methods, Limits of linear fracture mechanics, stress intensity factors and fracture toughness, Fatigue, Paris' law and stress corrosion laws, Non-linear fracture mechanical concepts and fracture resistance curves.

MEEN 6352: Non-Destructive Testing and Evaluation (2, 3, 3):

Basic concepts of Non-Destructive Testing and Evaluation. Instrumentation and materials. Radiographic techniques, ultrasonic and acoustic emission techniques, infrared and optical techniques. Eddy current testing. Magnetic and Liquid Penetrant Methods. Applications and laboratory sessions.

MEEN 6353: Tribology (3, 0, 3):

Introduction to tribology and tribological failure modes. Contact mechanics. Wear modeling and analysis. Roughness, hardness, friction. Thick pressurized fluid films in both hydrostatic and hydrodynamic bearings. Elasto-hydrodynamic lubrication, boundary lubrication mechanisms. Dry and lubricated bearing design. Applications: journal and rolling element bearings, cams and followers, gear teeth.

MEEN 6354: Reverse Engineering and Rapid Prototyping (2, 3, 3):

Introduction, terminology and principles. The role of CAD. Three-dimensional measurement and scanning, surface digitization strategies, curve and surface modeling. Characteristics and capabilities of specific Rapid Prototyping processes. Laboratory techniques will provide the necessary hands on experience.

MEEN 6359: Special Topics in Mechanical (3, 0, 3):

This course is delivered in light of the advent of new specializations in the field of mechanical systems design. Independent study is part of the course.