The mission of the Physical Sciences and Engineering (PSE) Division is to understand and manipulate matter at all scales – nano, meso, macro –, in all forms – from bulk, to divided colloids and fluids – as well as the interaction of matter with external stimuli in order to create knowledge, design new materials, model complex systems and engineer technologies in focused domains: water, energy, and the environment. Research in the Division and affiliated Research Centers includes areas such as catalysis and bioengineering; polymers and composites; computational chemistry and computational material sciences; energy production, storage and conversion; membranes for water purification, gas and liquid separation; novel materials, nanodevices and systems; theoretical physics and physical chemistry, sensors and smart devices for the detection of pollutants and the purification of air, water, and food; earth sciences, mechanics and geomechanics; oil exploration and recovery; and CO2 sequestration.

The PSE Division offers five graduate programs corresponding to five core disciplines: Chemical and Biological Engineering, Chemical Science, Earth Science and Engineering, Material Science and Engineering, and Mechanical Engineering. In all programs, students are offered modules consisting of lectures, seminars, and laboratory classes and are expected to conduct independent research. PSE also boasts excellent facilities and resources, in particular through its five Research Centers: Catalysis Center (KCC), Clean Combustion Research Center (CCRC), Solar & Photovoltaics Engineering Research Center (SPERC), Advanced Membranes and Porous Materials Center (AMPMC), that are all superbly equipped with most advanced instruments and techniques. The fifth Center, the Upstream Petroleum Engineering Research Center (UPERC), is under creation. With a pool of more than fifty renowned Faculty members, PSE provides students with a wide range of expertise for their scientific mentoring and education.

Prof. Yves Gnanou
Dean of Physical Science & Engineering Division
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1. Aims and Scope

The Mechanical Engineering (ME) program at KAUST aspires to become a World Leading ME program by focusing on cutting-edge basic and applied research in the following areas: structures and mechanics of solids, fluid dynamics, thermal sciences, combustion, energy, and control and dynamics. Furthermore, within each of these research areas, the emphasis is on interdisciplinary research, and collaborative research with top-tier institutions around the globe. The ME program also engages with the various research centers at KAUST, particularly the Clean Combustion Research Center.

The ME program course curriculum is modern and rigorous, and courses in the program provide a solid foundation in each area, covering subjects such as mechanical behavior of engineering materials, continuum mechanics, thermodynamics, experimental and numerical combustion, computational fluid dynamics, control theory, modeling, and simulation. Our graduates are technically well trained to be productive members of the modern world society at large and specifically suited for research careers in academia, and industry and government research laboratories.

2. Assessment Test

Students come to KAUST from a wide variety of programs and backgrounds. To facilitate the design of an appropriate study plan for each individual student, all incoming students without a M.S. degree will take an assessment in the orientation week. The purpose of the assessment is to determine whether students have mastered the prerequisites of graduate-level courses taught in the program. The Advisor uses the results of the assessments to design, if necessary, a study plan with a list of courses that would address content areas that may impede a student from successful completion of the degree requirements and that need improvement. Students are encouraged to prepare for the assessment by refreshing the general knowledge gained from their undergraduate education before arrival to KAUST.

The Program requirements must be satisfactorily completed in addition to the University degree requirements. These follow the program guide.

3. Master's Degree

The Master of Science (M.S.) degree at KAUST is a 36 credit program. Students are expected to complete the M.S. degree in three (3) semesters and one (1) summer session. Degree requirements are divided into three (3) sections:

- Core Curriculum
- Elective Curriculum
- Research/Capstone Experience

The M.S. degree is awarded upon successful completion of a minimum of 36 credit hours. A grade minimum GPA of 3.0 must be achieved to graduate. Individual courses require a minimum of a B- for course credit.

Core Courses (12 credit hours):
This portion of the degree is designed to provide a student with the background needed to establish a solid foundation in the program area.
Select four (4) Core Courses

Mathematics Requirement (6 credit hours):
At least two (2) graduate-level courses (i.e., courses numbered 200 and higher) in applied mathematics are required. It is recommended that students take Applied Mathematics I and II (AMCS 201 and 202), because these courses provide a strong foundation in applied mathematics, which is essential for a research career in ME. This portion of the degree is designed to provide a student with the background needed to establish a solid foundation in the program area. Select two (2) AMCS Courses, list provided in Master's Course Requirements.

Elective Courses (6 credit hours):
This portion of the degree is designed to allow each student to tailor his/her educational experience to meet individual research and educational objectives, with the permission of the student's Academic Advisor. Select two (2) Elective Courses, list provided in Master's Course Requirement.

Research/Capstone Experience (12 credit hours):
The details of this portion of the degree are uniquely determined by the student with the permission of the student's Academic Advisor and will involve a combination of research and other capstone experiences. A student is expected to work a minimum of 3 hours per week for each research credit he/she is registered.

Seminars/WEP
- Graduate Seminar 298 (non-credit): All students are required to register and receive satisfactory grades for three (3) semesters of the program Graduate Seminar to meet degree requirements.
- Winter Enrichment Program: Students are required to satisfactorily complete at least one (1) full Winter Enrichment Program (WEP).

Ph.D.-Level Courses:
- Students may also enroll in courses in the program numbered 300 or greater. If passed with a minimum grade of B-, these courses may be used towards meeting the Ph.D. requirements of the program should the student choose to earn a Ph.D. degree at KAUST.

3.1. Masters Course Requirements

Core Course
ME 200 a, b - Fluid Mechanics
ME 211 a, b - Mechanics of Structures and Solids
ME 212 a, b - Continuum Mechanics
ME 221 a, b - Control Theory
ME 222 a, b - Mechatronics and Intelligent Systems
ME 232 a, b - Advanced Dynamics
ME 234 a, b - Introduction to Kinematics and Robotics
ME 241 - Thermodynamics
ME 242 - Heat and Mass Transfer

**Elective Courses**

Two (2) graduate-level courses (i.e., courses numbered 200 and higher) must be chosen with the approval of the student's advisor.

- ME 214 - Experimental Methods
- ME 224 - System Identification and Estimation
- ME 226 - Fuzzy Sets in Engineering
- ME 231 - Introductory Concepts for Dynamical Systems
- ME 243 - Statistical Mechanics
- ME 244 - Combustion
- ME 250 - Energy
- ME 252 - Sustainable Energy Engineering
- ME 254 - Theory and Methods in Product Design
- ME 256 - Application of Atmospheric Pressure Plasma Engineering
- ME 300 - Advanced Fluid Mechanics
- ME 302 - Multi-Phase Flows
- ME 304 - Experimental Methods in Fluid Mechanics
- ME 305 a, b - Computational Fluid Dynamics
- ME 306 - Hydrodynamic Stability
- ME 307 - Turbulence
- ME 308 - Introduction to Plasma Physics and Magneto-hydrodynamics
- ME 310 - Mechanics and Materials Aspects of Fracture
- ME 312 - Dynamic Behavior of Materials
- ME 313 a, b - Theory of Structures
- ME 314 - Plasticity
- ME 315 - Computational Mechanics Using Particle Methods
- ME 316 - Micromechanics
- ME 317 a, b - Mechanics of Composite Materials and Structures
- ME 318 - Dynamic Fracture and Frictional Faulting
- ME 319 a, b - Computational Solid Mechanics
- ME 320 - Geometry of Nonlinear Systems
- ME 324 - Advanced Control Systems
- ME 326 - Robust Control
- ME 332 - Geometric Mechanics
- ME 340 - Advanced Combustion Theory
- ME 342 - Combustion Kinetics
- ME 344 - Gas Dynamics
- ME 348 - Introduction to Spectroscopy and Laser Diagnostics
- ME 400 - Contemporary Topics in Fluid Dynamics
- ME 410 - Contemporary Topics in Solid Mechanics
- ME 420 - Contemporary Topics in Control Theory and Practice
- ME 430 - Contemporary Topics in Dynamics
- ME 440 - Contemporary Topics in Thermal Science and Engineering
- ME 450 - Contemporary Topics in Design Theory and Practice

**Mathematics Requirement**

At least two (2) graduate-level courses (i.e., courses numbered 200 and higher) in applied mathematics is required. It is recommended that students take Applied Mathematics I and II (AMCS 201 and 202).

- AMCS 201 - Applied Mathematics I
- AMCS 202 - Applied Mathematics II

**Seminar**

- ME 398 - Graduate Seminar

---

**3.2 Thesis Option**

Students who choose to pursue a thesis are given the opportunity to complete a full research-based project with the guidance of a Thesis Advisor. Students must apply by the ninth week of their second semester and must have, at least, a 3.2 cumulative GPA.

A minimum of 12 credits of Thesis research (297) is required. Students are permitted to register for more than 12 credits of M.S. thesis research as necessary and with the permission of the Thesis Advisor.

The selected Thesis Advisor must be a ME Program or Program-affiliated faculty member. The student may also select an advisor from another Program at KAUST to become project-affiliated for the specific thesis project. Project-affiliation requires the approval of the ME Program Chair and must be prior to commencing research. Evaluation of satisfactory completion of M.S. Thesis work is performed by a committee comprised of the M.S. Thesis Advisor, as chair of the committee, another program-affiliated faculty member and one (1) faculty member from a different program at KAUST.

The committee must be approved by the Program Chair and the Dean at the same time that the student applies for the Thesis option of the M.S. degree.

For a list of faculty and their affiliations: http://www.kaust.edu.sa/faculty-advisors.htm.

**3.3 Thesis Defense Requirements**

A Written Thesis is required, Although this may be waiver by the Dean’s office. It is advisable that the student submits a final copy of the thesis to the Thesis Committee members at least two(2) weeks prior to the defense date.

The student is required to comply with the university formatting guidelines provided by the http://libguides.kaust.edu.sa/theses

The student is responsible for scheduling the thesis defense date with his/her M.S Thesis Defense Committee.

A pass is achieved when the committee agrees with no more than one (1) dissenting vote otherwise the student fails. The final approval must be submitted no more than three (3) days after the defense. MS Thesis Defense Committee

The MS Thesis Defense committee, which must be approved by the student’s Dean, must consist of at least...
three members, and typically includes no more than four members. At least two of the required members must be KAUST faculty. The Chair plus one additional faculty member must be affiliated with the student’s program. This membership can be summarized as:

<table>
<thead>
<tr>
<th>Member</th>
<th>Role</th>
<th>Program Status</th>
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<tbody>
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<td>4</td>
<td>Additional Faculty</td>
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</tr>
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</table>

Notes
- Members 1 – 3 are required. Member 4 are optional
- Co-chairs may serve as Member 2, 3 or 4, but may not be a Research Scientist
- Adjunct Professors and Professor Emeriti may retain their roles on current committees, but may not serve as chair on any new committees
- Professors of Practice and Research Professors may serve as Members 2, 3 or 4 depending upon their affiliation with the student’s program. They may also serve as co-chairs
- Visiting Professors may serve as Member 4

3.4 Non Thesis Option
Students wishing to pursue the non-thesis option must complete a minimum of 6 credits of directed research (299). Summer internship credits (295) may be used to fulfill the research requirement provided that the summer internship is research-based. Summer internships are subject to approval by the student’s Academic Advisor. A student may not enroll in more than one (1) summer internship.

Apart from Directed Research or Summer Internship, students must complete, with the approval of the Academic Advisor, one (1) or a combination of the following to earn the remaining credits of the degree requirement:
- Broadening Experience Courses: Courses that broaden a student’s M.S. experience, including courses from other programs at KAUST.

Ph.D.-Level Courses: Courses in the program numbered 300 or greater. If passed with a minimum grade of B–, these courses may be used towards meeting the Ph.D. requirements of the program should the student choose to earn a Ph.D. degree at KAUST.

4. Doctor of Philosophy
The Doctor of Philosophy (Ph.D.) degree is designed to prepare students for careers in research and industry. It is offered exclusively as a full-time program. There is a minimum residency requirement at KAUST of 3.5 years for students entering with a B.S. degree and 2.5 years for students entering with a M.S. degree. A minimum GPA of 3.0 must be achieved on all doctoral coursework. Individual courses require a minimum of a B- to earn course credit.

The Ph.D. program includes the following requirements:
- Designating a Dissertation Advisor.
- Successful completion of program coursework.
- Passing the Qualifying Examination.
- Passing the Dissertation Proposal Defense to obtain candidacy status.
- Preparing, submitting and successfully defending a Doctoral Dissertation.

4.1 Ph.D. Course Requirements
The required coursework varies for students entering the Ph.D. program with a B.S. degree or a relevant M.S. degree. Students holding a B.S. degree must complete all program core courses and elective courses outlined in the Master’s degree section and are also required to complete the Ph.D. courses below. Students entering with a B.S. degree may also qualify to earn the M.S. degree by satisfying the M.S. degree requirements. However, it is the student’s responsibility to declare his/her intention.

Students entering the Ph.D. program with a relevant M.S. degree must complete the requirements below, though additional courses may be required by the Dissertation Advisor.
- Two 300-level Mechanical Engineering courses, one (1) Applied Mathematics course, one (1) elective course.
- Graduate Seminar 398 (non-credit): All students are required to register and receive Satisfactory grades for four (4) semesters of the program Graduate Seminar.
- Winter Enrichment Program: Students are required to Satisfactorily complete at least one (1) full Winter Enrichment Program (WEP) as part of the degree requirements. Students who completed WEP requirements while earning the M.S. degree are not required to enroll in WEP for a second time in the Ph.D. degree.

Students entering the program with a M.S. degree from KAUST may transfer coursework toward the Ph.D. program requirements with approval from the Program Chair.

Students transferring from another university Ph.D. program may receive some dissertation research and coursework credits on a case-by-case basis for related work performed at the original institution upon approval by the Dean. However, such students must still satisfy the Qualifying Exam and Dissertation Proposal Defense requirements at KAUST.
4.2 Designation of Dissertation Advisor
The Ph.D. Dissertation Advisor can be any program-affiliated faculty member. The student may also select an advisor from another program at KAUST to become project-affiliated for the specific dissertation project only with the approval of the ME Faculty. Project-affiliation approval must be completed prior to commencing research. For a list of faculty and their affiliations: http://www.kaust.edu.sa/faculty-advisors.html

4.3 Qualification Phase
After completion of the course requirements, the student must begin Dissertation Research (ME 397) and successfully complete the required Ph.D. Qualification Milestones to be considered a Ph.D. candidate. These milestones consist of the Qualifying Examination and the Dissertation Proposal Defense.

Qualifying Examination
The purpose of the Qualifying Exam is to test the student’s knowledge of the subject matter within the field of study. All students entering the Ph.D. program with a B.S. degree must take this examination within two (2) years of their admission. Students admitted to the program with an M.S. degree must take this exam within one (1) year. Students who fail the Qualifying Examination or who fail the retake will be dismissed from the university. For further information regarding the details of the Qualifying Examination please contact your GPC.

One (1) of the following three (3) outcomes is possible
- Pass: The student is qualified for the doctoral program.
- Failure with retake permitted: The student is not qualified for the doctoral program but allowed to retake the examination one (1) more time.
- Failure: The student is not qualified for the doctoral program and is not allowed to retake the examination exam. Students who are not permitted to retake the exam, or who fail the retake, are dismissed from the University.

4.4 Preliminary Dissertation Committee
The Preliminary Dissertation Committee must include the following members:
- First member: Dissertation Advisor who acts as committee chair.
- Second member: Program or Program-affiliated faculty member.
- Third member: KAUST faculty member from another program.

The Preliminary Dissertation Committee must be approved by the Program Chair and the Dean. Once constituted, the composition of the preliminary committee can only be changed with the approval of both the Dissertation Advisor and the Dean.

4.5 Dissertation Proposal Defense
The purpose of the Dissertation Proposal Defense is to demonstrate that the student has the ability and is adequately prepared to undertake Ph.D. level research in the proposed area. This preparation includes necessary knowledge of the chosen subject, a review of the literature, and preparatory theory or experiment as applicable. The Dissertation Proposal Defense is the second part of the qualification milestones that must be completed to become a Ph.D. Candidate. Ph.D. students are required to complete the Dissertation Proposal Defense within one (1) year after passing the Qualifying Exam. The Dissertation Proposal Defense includes two (2) aspects: a written research proposal and an oral research proposal defense. Ph.D. students must request to present the Dissertation Proposal Defense to the Preliminary Dissertation Committee at the beginning of the semester they will defend their proposal.

Dissertation Proposal Defense Evaluation
There are three (3) possible outcomes from this Dissertation Proposal Defense:
- Pass: The student passed the exam and may proceed to independent study and research for the doctoral degree. The “pass” decision is achieved by the unanimous vote of the committee.
- Failure with retake permitted: If at least one (1) member casts a negative vote, one (1) retake of the examination is permitted if the entire committee agrees. The student must prepare a new research proposal and be examined again within the next six (6) months. Students are allowed no more than one (1) retake.
- Failure: If at least one (1) member casts a negative vote and retake of the examination is not permitted, the student has failed the exam and will be dismissed from the program.

Students who fail the Dissertation Proposal Defense or who fail the retake will be dismissed from the university. A student who successfully passes the Dissertation Proposal Defense is deemed a Ph.D. Candidate.

4.6 Dissertation and Final Defense
The Ph.D. degree requires acceptance of the Dissertation and the passing of the final defense. The final defense is a public presentation that consists of an oral defense followed by questions and may last a maximum of three (3) hours.

4.7 Dissertation Committee
The Ph.D. degree requires acceptance of the Dissertation and the passing of the final defense. The final defense is a public presentation that consists of an oral defense followed by questions and may last a maximum of three (3) hours.
The PhD Dissertation Defense committee, which must be approved by the student's Dean, must consist of at least four members, and typically includes no more than six members. At least three of the required members must be KAUST faculty and one must be an examiner who is external to KAUST. The Chair plus one additional faculty member must be affiliated with the student's program. The external examiner, is not required to attend the defense, but must write a report on the dissertation and may attend the dissertation defense at the discretion of the Program. This membership can be summarized as:

**Member Role Program Status:**

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<tr>
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<td>External Examiner</td>
<td>Outside KAUST</td>
</tr>
<tr>
<td>5</td>
<td>Approved Research Scientist</td>
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Notes
- Members 1 – 4 are required. Members 5 and 6 are optional
- Co-chairs may serve as either Member 2, 3 or 6
- Adjunct Professors and Professor Emeriti may retain their roles on current committees, but may not serve as chair on any new committees
- Professors of Practice and Research Professors may serve as Members 2, 3 or 6 depending upon their affiliation with the student’s program. They may also serve as co-chairs
- Visiting Professors may serve as Member 6, but not as the external examiner

The Preliminary Dissertation Committee members can serve on the P.h.D. Dissertation Defense Committee subject to the Committee rules. Three (3) months before the final defense date the Dissertation Advisor is responsible for nominating three (3) well-qualified, potential External Examiners to the Program Chair who will appoint one (1) among the three (3) nominees to the student’s Dissertation Defense Committee. The External Examiner must hold a Full or Associate Professor position at a university other than KAUST. The External Examiner will review the dissertation and send a report within 3 weeks sharing his/her recommendations and questions prior to the final defense. Beyond the External Examiner, up to two (2) additional members can be added. All committee members must attend the final defense, by video conference if necessary.

The External Examiner must hold a Full or Associate Professor position at a university other than KAUST. The External Examiner will review the dissertation and send a report within three (3) weeks sharing his/her recommendations and questions prior to the final defense. Beyond the External Examiner, up to two (2) additional members can be added. All committee members must attend the final defense, by video conference if necessary.

**Timeline**

The student must determine the defense date with agreement of all the members of the Dissertation Committee. It is the responsibility of the student to notify the GPC at the beginning of the semester they intend to defend. It is expected that the student submits her/his written dissertation to the committee two (2) months prior to the defense date in order to receive feedback in a timely manner. The written dissertation is required to comply with the university formatting guidelines provided by the library: http://libguides.kaust.edu.sa/theses.

**Evaluation**

There are two (2) possible outcomes for Final Defense:
- **Pass:** with or without conditions.
- **Fail:** with or without retake permitted.

A pass is achieved when the committee agrees unanimously otherwise the student fails.

In the instance of a Pass with Conditions, the entire committee must agree on the required conditions and if they cannot, the Dean decides. The deadline to complete the conditions is one (1) month after the defense date unless the committee unanimously agrees to reduce it.

In the instance of a Fail without Retake Permitted, the decision of the committee must be unanimous. Otherwise one (1) retake is permitted. The deadline to complete the retake is four (4) months after the defense date unless the committee unanimously agrees to reduce it. Students who fail the Final Dissertation Defense or who fail the retake will be dismissed from the university.

Evaluation of the Ph.D. Dissertation Defense is recorded by submitting the Result of Ph.D. Dissertation Defense Examination form within three (3) days after the defense.

**Final Submission**

Once post-examination corrections to the final dissertation document are made, students must submit the final draft of the dissertation document to Turnitin through Blackboard to complete an Originality Report. The Dissertation Advisor will confirm authenticity of this document. Upon this confirmation, the following forms must be submitted:
- Final version of the Dissertation
- Copyright Availability form
- Signed Final Approval of Dissertation for the Degree of Doctor of Philosophy form

**4.8 Dissertation and Final Defense**

The Ph.D. degree requires acceptance of the Dissertation and the passing of the final defense. The final defense is a public presentation that consists of an oral defense.
followed by questions and may last a maximum of three (3) hours.

Timeline
The student must determine the defense date with agreement of all the members of the Dissertation Committee. It is the responsibility of the student to notify the Graduage Program Coordinator at the beginning of the semester they intend to defend. It is expected that the student submits their written dissertation to the committee (2) months prior to the defense date in order to receive feedback. The written dissertation is required to comply with the university formatting guidelines provided by the library: http://libguides.kaust.edu.sa/theses.

Evaluation

There are two (2) possible outcomes for Final Defense:

- **Pass**: with or without conditions.
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A pass is achieved when the committee agrees unanimously otherwise the student fails.

In the instance of a Pass with Conditions, the entire committee must agree on the required conditions and if they cannot, the Dean decides. The deadline to complete the conditions is one (1) month after the defense date unless the committee unanimously agrees to reduce it.

In the instance of a Fail without Retake Permitted, the decision of the committee must be unanimous. Otherwise one (1) retake is permitted. The deadline to complete the retake is four (4) months after the defense date unless the committee unanimously agrees to reduce it. Students who fail the Final Dissertation Defense or who fail the retake will be dismissed from the university.

Evaluation of the Ph.D. Dissertation Defense is recorded by submitting the Result of Ph.D. Dissertation Defense Examination form within three (3) days after the defense.

Final Submission

Once post-examination corrections to the final dissertation document are made, students must submit the final draft of the dissertation document to Turnitin through Blackboard to complete an Originality Report. The Dissertation Advisor will confirm authenticity of this document. Upon this confirmation, the following forms must be submitted:

- Final version of the Dissertation.
- Copyright Availability form.
- Signed Final Approval of Dissertation for the Degree of Doctor of Philosophy form.

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5. Program Courses and Descriptions

**ME 100 - Basic Principles of Mechanics (3-0-0)**
Prerequisite: None.

**SOLID MECHANICS**: Equilibrium conditions and determination of forces on structures, Determination of internal force systems in structures, Definitions of stress and strain, Mechanical properties of solid materials, Structural components under axial loads, torsional loads, bending, and combined loads, beam theory. **FLUID MECHANICS**: Fluid properties, fluid forces, fluid statics and kinematics, Conservation of mass, momentum and energy in fixed, deforming, and moving control volumes, boundary layer concept, lift and drag, pressure and friction drag, streamlining and drag reduction. **DYNAMICS & VIBRATIONS**: Kinematics of particles, Kinetics of a particles, Work and energy methods for particles, Vibrations of particles, Planar kinematics of rigid bodies, Planar kinetics of rigid bodies, Work and energy methods for rigid bodies, Vibrations of rigid bodies.

**ME 101 - Basic Principles of Thermodynamics (3-0-0)**
Prerequisite: None.

Pressure, temperature and general properties, work and heat transfer in processes, power, conservation principle for mass and energy, reversible processes, the 2nd law of thermodynamics, steady state devices, transient processes, heat engines, power producing cycles, refrigerator and heat pumps, basic constrained optimization based on Lagrange multipliers (needed for chemical equilibrium), basic differentiation skills and understanding of homogeneous functions (for mathematical thermodynamics).

**ME 200 a, b - Fluid Mechanics (3-0-3); first, second terms**
Prerequisite: Undergraduate fluid mechanics, AMCS 201 (for ME200a) and AMCS 202 (for ME 200b) or equivalent (may be taken concurrently); ME 200b requires ME 200a.

Fundamentals of fluid mechanics. Microscopic and macroscopic properties of liquids and gases; the continuum hypothesis; review of thermodynamics; general equations of motion; kinematics; stresses; constitutive relations; vorticity, circulation; Bernoulli’s equation; potential flow; thin-airfoil theory; surface gravity waves; buoyancy-driven flows; rotating flows; viscous creeping flow; viscous boundary layers; introduction to stability and turbulence; quasi one-dimensional compressible flow; shock waves; unsteady compressible flow; acoustics.
ME 211 a, b - Mechanics of Structures and Solids (3-0-3); first, second terms
Prerequisite: Undergraduate strength of materials and stress analysis; ME 211b requires ME211a
Static stress analysis. Basic concepts of continuum mechanics. Variational theorems and approximate solutions. Introduction to fracture mechanics, damage mechanics and theory of plasticity. A variety of special topics will be discussed in the second term such as, but not limited to: homogenization strategies, anisotropic damage theory, micromechanics of cracking in laminated media and micromechanics based damage models, identification of parameters of models of materials by Digital Image Correlation.

ME 212 a, b - Continuum Mechanics (3-0-3); first, second terms

ME 214 - Experimental Methods (2-1-3)
Prerequisite: AMCS 201 and AMCS 202 or equivalent (may be taken concurrently), ME 200 a,b or ME 211 a, b or equivalent (may be taken concurrently). Lectures on experiment design and implementation. Measurement methods, transducer fundamentals, instrumentation, optical systems, signal processing, noise theory, analog and digital electronic fundamentals, with data acquisition and processing systems.

ME 221 a, b - Control Theory (2-1-3); first, second terms
Prerequisite: Undergraduate Calculus of One and Several Variables, Linear Algebra, Differential Equations, Probability and Statistics or equivalents; AMCS 201 and AMCS 202 or equivalent may be taken concurrently; ME 221b requires ME 221a. An introduction to analysis and design of feedback control systems, including classical control theory in the time and frequency domain. Modeling of physical, biological, and information systems using linear and nonlinear differential equations. Linear vs. nonlinear models, and local vs. global behavior. Input/output response, modeling and model reduction. Stability and performance of interconnected systems, including use of block diagrams, Bode plots, the Nyquist criterion, and Lyapunov functions. Robustness and uncertainty management in feedback systems through stochastic and deterministic methods. Basic principles of feedback and its use as a tool for altering the dynamics of systems and managing uncertainty methods. Introductory random processes, Kalman filtering, and norms of signals and systems.

ME 222 a, b - Mechatronics and Intelligent Systems (2-1-3); first, second terms:
Prerequisite: ME 222b requires ME22a.

ME 224 - System Identification and Estimation (3-0-3)
Prerequisite: ME 221 a,b (ME 221 b can be taken concurrently).

ME 226 - Fuzzy Sets in Engineering (3-0-3)
Prerequisite: AMCS 201 and AMCS 202, working knowledge of the C computer programming language.
The relatively new mathematics of fuzzy sets has recently been used to represent and manipulate vague and imprecise information in engineering. This course will present the basics of fuzzy sets and fuzzy mathematics and explore applications in the areas of data representation; function representation; filters and triggers; engineering design and optimization, including (fuzzy) set-based concurrent engineering.

ME 231 - Introductory Concepts for Dynamical Systems (3-0-3)
Prerequisite: Undergraduate Calculus of One and Several Variables, Linear Algebra, Differential Equations, Probability and Statistics or equivalents.
Nonlinear system dynamics. Initial-and boundary-value problems, ordinary and partial differential equations. Hybrid system models; modeling/simulation environments such as Dymola, Modelica, Ptolemy, Simulink and StateFlow. Networked system models. System analysis: elementary discretization methods, initial value, ordinary differential equation theory; linearization; convolution, state-space and frequency domain representations; stability, input/output operator norms, least squares and
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 232 a, b</td>
<td>Advanced Dynamics (3-0-3); first, second terms</td>
<td>AMCS 201 and AMCS 202 or equivalents (may be taken concurrently); ME 232 b requires ME 232a.</td>
</tr>
<tr>
<td>ME 234 a, b</td>
<td>Introduction to Kinematics and Robotics (3-0-3); first, second terms</td>
<td>AMCS 201 and AMCS 202 or equivalent (may be taken concurrently); ME 234b requires ME 234a.</td>
</tr>
<tr>
<td>ME 241</td>
<td>Thermodynamics (3-0-3)</td>
<td>Undergraduate thermodynamics, AMCS 201 and AMCS 202 (may be taken concurrently) or equivalent.</td>
</tr>
<tr>
<td>ME 242</td>
<td>Heat and Mass Transfer (3-0-3)</td>
<td>Undergraduate thermodynamics, AMCS 201 (may be taken concurrently).</td>
</tr>
<tr>
<td>ME 243</td>
<td>Statistical Mechanics (3-0-3)</td>
<td>AMCS 201 or equivalent (may be taken concurrently).</td>
</tr>
<tr>
<td>ME 244</td>
<td>Combustion (3-0-3)</td>
<td>ME 241 or equivalent.</td>
</tr>
<tr>
<td>ME 250</td>
<td>Energy (3-0-3)</td>
<td>ME 241 or equivalent.</td>
</tr>
<tr>
<td>ME 252</td>
<td>Sustainable Energy Engineering (3-0-3)</td>
<td>Undergraduate Thermodynamics, AMCS 201 and AMCS 202 (may be taken concurrently), ME 250.</td>
</tr>
<tr>
<td>ME 254</td>
<td>Theory and Methods in Product Design (2-1-3)</td>
<td>Graduate standing in mechanical engineering or consent of instructor.</td>
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</tbody>
</table>

*Note: The course descriptions include topics such as thermodynamics, statistical mechanics, heat and mass transfer, dynamics of rigid bodies, and more. Each course is designed to build on foundational knowledge and introduce advanced topics in engineering and physics.*
a design or feasibility study chosen to emphasize innovation and ingenuity and provide wide coverage of engineering topics. Design optimization and social, economic and political implications are included. Emphasis on hands-on creative components, teamwork and effective communication. Special emphasis on management of innovation processes for sustainable products, from product definition to sustainable manufacturing and financial models. The patent process. Both individual and group oral presentations are made, and participation in conferences is required.

**ME 256 - Computer-Aided Engineering Design (2-1-3)**
Prerequisite: AMCS 201 and AMCS 202, working knowledge of the C computer programming language.
Methods and algorithms for design of engineering systems using computer techniques. Topics include the design process; interactive computer graphics; curves and surfaces (including cubic and B-splines); solid modeling (including constructive solid geometry and boundary models); kinematic and dynamic mechanism simulation; single and multivariable optimization; optimal design, and symbolic manipulation. Assessment of CAD as an aid to the design process.

**ME 261 - Application of Atmospheric Pressure Plasma (3-0-3)**
Prerequisite: None.

**ME 295 - Internship (6 credits)**
Prerequisite: Approval of Academic Advisor.
Master's-level summer internship.

**ME 297 - Thesis Research (variable credits)**
Prerequisite: Approval of Thesis Advisor.
Master's-level thesis research.

**ME 299 - Directed Research (variable credits)**
Prerequisite: M.S. status and consent of instructor.
Course may be repeated for credit and must be taken on a satisfactory/unsatisfactory basis.

**ME 300 - Advanced Fluid Mechanics (3-0-3)**
Prerequisite: ME 200 a, b or equivalent; AMCS 201 and AMCS 202 (may be taken concurrently).
A more rigorous mathematical introduction to fluid mechanics. Derivation of Navier-Stokes; physical properties of real gases; the equations of motion of viscous and inviscid dynamics; the dynamical significance of vorticity; vortex dynamics; Kelvin circulation theorem and consequences; Biot-Savart Law, exact solutions in vortex dynamics; motion at high Reynolds numbers; hydrodynamic stability; boundary layers; flow past bodies; compressible flow; subsonic, transonic, and supersonic flow; Lax theory of shock waves.

**ME 302 - Multi-Phase Flows (3-0-3)**
Prerequisite: ME 241, AMCS 201 and AMCS 202, ME 200 a, b, ME 211 a, b or equivalents.
Selected topics in engineering two-phase flows with emphasis on practical problems in modern hydro-systems. Fundamental fluid mechanics and heat, mass, and energy transport in multiphase flows. Liquid/vapor (LVG) flows, nucleation, bubble dynamics, cavitating and boiling flows, models of LVG flows; instabilities, dynamics, and wave propagation; fluid/structure interactions. Discussion of two-phase flow problems in conventional, nuclear, and geothermal power plants, marine hydrofoils, and other hydraulic systems.

**ME 304 - Experimental Methods in Fluid Mechanics (2-1-3)**
Prerequisite: ME 200 a, b or equivalent; AMCS 201 and AMCS 202 (may be taken concurrently).

**ME 305 a, b - Computational Fluid Dynamics (3-0-3); first, second terms.**
Prerequisite: ME 200 a, b or equivalent; AMCS 201 and AMCS 202 or equivalent; ME 305b requires ME 305a.
Introduction to floating point arithmetic. Introduction to numerical methods for Euler and Navier-Stokes equations with emphasis on error analysis, consistency, accuracy and stability. Modified equation analysis (dispersion vs. dissipation) and Von Neumann stability analysis. Finite difference methods, finite volume and spectral element methods. Explicit vs. implicit time stepping methods. Solution of systems of linear algebraic systems. Higher-order vs. higher resolution methods. Computation of turbulent flows. Compressible flows with high-resolution shock-capturing methods (e.g. PPM, MUSCL, WENO). Theory of Riemann problems and weak solutions for hyperbolic equations.

**ME 306 - Hydrodynamic Stability (3-0-3)**
Prerequisite: ME 200 a, b or equivalent; AMCS 201 and AMCS 202 (may be taken concurrently).
Laminar-stability theory as a guide to laminar-turbulent transition. Rayleigh equation, instability criteria, and response to small inviscid disturbances. Discussion of Kelvin-Helmholtz, Rayleigh-Taylor, Richtmyer-Meshkov, and other instabilities, for example, in geophysical flows. The Orr-Sommerfeld equation, the dual role of viscosity, and boundary-layer stability. Modern concepts such as pseudo-momentum conservation laws and nonlinear stability theorems for 2-D and geophysical flows.

**ME 307 - Turbulence (3-0-3)**
Prerequisite: ME 200 a, b; AMCS 201 and AMCS 202.
ME 308 - Introduction to Plasma Physics and Magnetohydrodynamics (3-0-3)
Prerequisite: ME 200 ab; AMCS 201 and AMCS 202.

ME 310 - Mechanics and Materials Aspects of Fracture (3-0-3)
Prerequisite: ME 211 a, b (concurrently) or equivalent.
Analytical and experimental techniques in the study of fracture in metallic and nonmetallic solids. Mechanics of brittle and ductile fracture; connections between the continuum descriptions of fracture and micromechanisms. Discussion of elastic-plastic fracture analysis and fracture criteria. Special topics include fracture by cleavage, void growth, rate sensitivity, crack deflection and toughening mechanisms, as well as fracture of nontraditional materials. Fatigue crack growth and life prediction techniques will also be discussed. In addition, “dynamic” stress wave dominated, failure initiation growth and arrest phenomena will be covered. This will include traditional dynamic fracture considerations as well as discussions of failure by adiabatic shear localization.

ME 312 - Dynamic Behavior of Materials (3-0-3)
Prerequisite: AMCS 201 and AMCS 202 or equivalent; ME 211 a, b.
Fundamentals of theory of wave propagation; plane waves, wave guides, dispersion relations; dynamic plasticity, adiabatic shear banding; dynamic fracture; shock waves, equation of state.

ME 313 a, b - Theory of Structures (3-0-3); first, second terms
Prerequisite: ME 313b requires ME 313a.
Geometry of spatial curves; finite 3-D rotations; finite deformations of curved rods; dynamics of rods; strings and cables; theory of plastic rods; statistical mechanics of chains; applications including frames and cable structures, polymers, open-cell foams, DNA mechanics, cell mechanics; small strain and von Karman theory of plates; applications to thin films, layered structures, functionally graded thin films, delamination, plastic collapse; surface geometry; finite deformations of shells; dynamics of plates and shells; membranes; theory of plastic plates and shells; fracture of plates and shells; elastic and plastic stability; wrinkling and relaxation; applications including solar sails, space structures, closed cell foams, biological membranes; numerical methods for structural analysis; discrete geometry; finite elements for rods, plates and shells; time-integration methods; thermal analysis.

ME 314 - Plasticity (3-0-3)
Prerequisite: ME 211 a, b. Theory of dislocations in crystalline media.
Characteristics of dislocations and their influence on the mechanical behavior in various crystal structures. Application of dislocation theory to single and polycrystal plasticity. Theory of the inelastic behavior of materials with negligible time effects. Experimental background for metals and fundamental postulates for plastic stress-strain relations. Variational principles for incremental elastic plastic problems, uniqueness. Upper and lower bound theorems of limit analysis and shakedown. Slip line theory and applications. Additional topics may include soils, creep and rate-sensitive effects in metals, the thermodynamics of plastic deformation, and experimental methods in plasticity.

ME 315 - Computational Mechanics Using Particle Methods (3-0-3)
Prerequisite: ME 319 a, b or equivalent.
Particle simulations of continuum and discrete systems. Advances in molecular, mesoscopic, and macroscale simulations using particles, identification of common computing paradigms and challenges across disciplines, discretizations and representations using particles, fast summation algorithms, time integrators, constraints, and multiscale resolution. Exercises will draw on problems simulated using particles from diverse areas such as fluid and solid mechanics, computer graphics, and nanotechnology.

ME 316 - Micromechanics (3-0-3)
Prerequisite: AMCS 201 and AMCS 202 or equivalent, ME 211 a, b and ME 212 a, b or instructor’s permission.
The course gives a broad overview of micromechanics, emphasizing the microstructure of materials, its connection to Mechanical Engineering. Courses molecular structure, and its consequences on macroscopic properties. Topics include phase transformations in crystalline solids, including martensitic, ferroelectric, and diffusion phase transformations, twinning and domain patterns, active materials; effective properties of composites and polycrystals, linear and nonlinear homogenization; defects, including dislocations, surface steps, and domain walls; thin films; asymptotic methods, morphological instabilities, self-organization; selected applications to microactuation, thin-film processing, composite materials, mechanical properties, and materials design. Open to undergraduates with instructor’s permission.

ME 317 a, b - Mechanics of Composite Materials and Structures (3-0-3); first, second terms
Prerequisite: ME 211a; ME 212a; ME 317b requires ME 317a.
Introduction and fabrication technologies. Elastic response of composite materials (especially fiber and particulate reinforced materials) from the fabrication to the in-service structure. Up scaling strategies from the microstructure to the single ply; kinematic and static bounds, asymptotic expansion and periodical homogenization. Up scaling strategies from the single ply to the structural scale: elastic deformation of multidirectional laminates (lamination theory, ABD matrix). Mechanics of degradation in composite materials: fiber-matrix debonding, plasticity, microcracking and induced delamination. Tools for description of non-linear effects: damage mechanics for laminates, applications of fracture mechanics. Aging and fatigue. Basic criteria-based theories will also be reviewed, including first ply failure, splitting and delamination. Basic experimental illustration will include: hand lay up of a simple laminate, characterization using full field measurement of its material properties.

ME 318 - Dynamic Fracture and Frictional Faulting (3-0-3)
Prerequisite: ME 211 a, b or ME 212 a, b.
Introduction to elastodynamics and waves in solids. Dynamic fracture theory, energy concepts, cohesive zone models. Friction laws, nucleation of frictional instabilities, dynamic rupture of frictional interfaces. Radiation from moving cracks. Thermal effects during dynamic fracture and faulting. Crack branching and faulting along nonplanar interfaces. Related dynamic phenomena, such as adiabatic shear localization. Applications to engineering phenomena and physics and mechanics of earthquakes.
ME 319 a, b - Computational Solid Mechanics (3-0-3); first, second terms
Prerequisite: AMCS 201 and AMCS 202 or equivalent; ME 211 a,b or ME 212 a,b (may be taken concurrently); ME 319b requires ME 319a.

ME 320 - Geometry of Nonlinear Systems (3-0-3)
Prerequisite: AMCS 202.

ME 324 - Advanced Control Systems (3-0-3)
Prerequisite: AMCS 201 and AMCS 202 or equivalent; ME 221 ab or equivalent.

ME 326 - Robust Control (3-0-3)
Prerequisite: AMCS 201 and AMCS 202 or equivalents; ME 221 ab or equivalent.
Linear systems, realization theory, time and frequency response, norms and performance, stochastic noise models, robust stability and performance, linear fractional transformations, structured uncertainty, optimal control, model reduction, m analysis and synthesis, real parametric uncertainty, Kharitonov’s theorem, uncertainty modeling.

ME 332 - Geometric Mechanics (3-0-3)
Prerequisite: ME 232 a, b.
The geometry and dynamics of Lagrangian and Hamiltonian systems, including symplectic and Poisson manifolds, variational principles, Lie groups, momentum maps, rigid-body dynamics, Euler-Poincaré equations, stability, and an introduction to reduction theory. More advanced topics (taught in a course the following year) will include reduction theory, fluid dynamics, the energy momentum method, geometric phases, bifurcation theory for mechanical systems, and nonholonomic systems.

ME 340 - Advanced Combustion Theory (3-0-3)
Prerequisite: ME 244 or equivalent.

ME 342 - Combustion Kinetics (3-0-3)
Prerequisite: ME 244 or ME 344.
Non-equilibrium processes in chemically reacting gases. Example applications to combustion, atmospheric chemistry, plasmas, chemical and materials processing, rocket nozzles, and gaseous lasers. Bimolecular reaction theory (collision theory); transition state theory; unimolecular and association reactions; complex reactions; straight chain reactions; explosions and branched chain reactions; photochemistry, photophysics; energy transfer in fuel tracers; vibrational relaxation; experimental techniques.

ME 344 - Gas Dynamics (3-0-3)
Prerequisite: ME 241.
Concepts and techniques for description of high-temperature and chemically reacting gases from a molecular point of view. Introductory kinetic theory; chemical thermodynamics; statistical mechanics as applied to properties of gases and gas mixtures; transport and thermodynamic properties; law of mass action; equilibrium chemical composition; Maxwellian and Boltzmann distributions of velocity and molecular energy; examples and applications from areas of current interest such as combustion and materials processing.

ME 346 - Turbulent Combustion (3-0-3)
Prerequisite: ME 244, ME 307 or equivalent.

ME 348 - Introduction to Spectroscopy and Laser Diagnostics (3-0-3)
Prerequisite: ME 241 or ME 344.
Fundamentals of microwave, infrared, Raman, and electronic spectroscopy. Laser-based diagnostic techniques for measurements of species concentration, temperature, pressure, velocity, and other flow field properties. Topics: rotational, vibrational, and electronic transition frequencies; spectral lineshapes and line-broadening mechanisms; nuclear spin effects; electronic spectra of atoms and molecules; absorption; emission; laser induced fluorescence (LIF); Rayleigh and Raman scattering methods; Mie theory; laser Doppler velocimetry (LDV) and particle image velocimetry (PIV); applications and case studies.Laser Diagnostics for Thermal Engineering.

ME 395 - Internship (6 credits)
Prerequisite: Approval of Dissertation Advisor. Doctoral-level summer internship.
ME 397 - Dissertation Research (variable credits)
Prerequisite: Ph.D. status and consent of instructor. Course may be repeated for credit. Maximum number of
**ME 398 - Graduate Seminar (non-credit)**
Prerequisite: None.
All candidates for the Ph.D. degree in mechanical engineering are required to attend one graduate seminar in Mechanical Engineering each week for at least one semester. In case the ME seminar is not held in any particular week, then it is the student's responsibility to attend any other technical seminar on campus that week. Graded satisfactory/unsatisfactory.

**ME 399 - Directed Research (variable credits)**
Prerequisite: Approval of Dissertation Advisor. Doctoral-level supervised research.

**ME 400 - Contemporary Topics in Fluid Mechanics (3-0-3)**
Prerequisite: ME 200 a, b and consent of the instructor.
Lecture and/or seminar course on advanced topics in fluid mechanics. Topics are determined by the instructor and may vary from year to year. The course may be repeated for credit.

**ME 410 - Contemporary Topics in Solid Mechanics (3-0-3)**
Prerequisite: ME 211 a, b, ME 212 a, b and consent of the instructor.
Lecture and/or seminar course on advanced topics in solid mechanics. Topics are determined by the instructor and may vary from year to year. The course may be repeated for credit.

**ME 420 - Contemporary Topics in Control Theory and Practice (3-0-3)**
Prerequisite: ME 221 a, b and consent of the instructor.
Lecture and/or seminar course on advanced topics in control theory and practice. Topics are determined by the instructor and may vary from year to year. The course may be repeated for credit.

**ME 430 - Contemporary Topics in Dynamics (3-0-3)**
Prerequisite: ME 232 a, b and consent of the instructor.
Lecture and/or seminar course on advanced topics in dynamics. Topics are determined by the instructor and may vary from year to year. The course may be repeated for credit. Maximum number of credits is 3 per semester.

**ME 440 - Contemporary Topics in Thermal Science and Engineering (3-0-3)**
Prerequisite: ME 241 and ME 242 or ME 244 and consent of the instructor.
Lecture and/or seminar course on advanced topics in thermal science and engineering. Topics are determined by the instructor and may vary from year to year. The course may be repeated for credit.

**ME 450 - Contemporary Topics in Design Theory and Practice (3-0-3)**
Prerequisite: ME 254 and consent of the instructor.
Lecture and/or seminar course on advanced topics in design theory and practice. Topics are determined by the instructor and may vary for year to year. The course may be repeated for credit.

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**6. Kaust Programs Guide Fall 2015**
**Office of the Registrar**

**6.1 Program and Degrees**
King Abdullah University of Science and Technology (KAUST) advances science and technology through bold and collaborative research. It educates scientific and technological leaders, catalyzes the diversification of the Saudi economy and addresses challenges of regional and global significance, thereby serving the Kingdom, the region and the world.

Research and education, as well as their transformative potential, are central to KAUST's mission. KAUST has a three (3)-part mission:

- Research at KAUST – both basic and goal-oriented – is dedicated to advancing science and technology of regional and global impact. Research excellence inspires teaching and the training of future leaders in science and technology.
- Research and education at KAUST energize innovation and enterprise to support knowledge-based economic diversification.

Through the synergy of science and technology, and innovation and enterprise, KAUST is a catalyst for transforming people's lives.

In support of this mission, King Abdullah University of Science and Technology offers eleven graduate programs leading to M.S. and Ph.D. degrees.

**KAUST Offers the Following two (2) Degrees**
The M.S. degree typically takes three (3) semesters and a summer to complete (18 months). The degree allows flexibility for internships, research, and academics. Learn more about M.S. degree requirements.

The Ph.D. degree is typically a three (3)- to four (4)-year post-master’s degree. The Ph.D., involves original research, culminating in a research dissertation. Learn more about Ph.D. degree requirements.

Three (3) academic divisions, these are:

- Biological and Environmental Sciences and Engineering (BESE)
- Bioscience (B)
- Environmental Science and Engineering (EnSE)
- Marine Science (MarS)
- Plant Science (PS)

- Computer, Electrical and Mathematical Sciences and Engineering (CEMSE)
- Applied Mathematics and Computational Science (AMCS)
- Computer Science (CS)
- Electrical Engineering (EE)

- Physical Sciences and Engineering Division (PSE)
- Chemical and Biological Engineering (CBE)
- Chemical Sciences (ChemS)
- Earth Science and Engineering (ErSE)
- Materials Science and Engineering (MSE)
- Mechanical Engineering (ME)

Each program is administered by a Graduate Committee and a Graduate Chair. Courses for each program will be listed at the 100 (non-credit), 200, 300 or 400 level.

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**7. Master's Program**
Admissions
Admission to the M.S. program requires the satisfactory completion of an undergraduate B.S. degree in a relevant or related area, such as Engineering, Mathematics or the Physical, Chemical and Biological Sciences.

Master’s Degree requirements
The MS degree requires successful completion of 36 credits. Students are expected to complete the MS degree in three (3) semesters plus one (1) summer session. Degree requirements are divided into three (3) sections: Core Curriculum; Elective Curriculum; and Research/Capstone Experience.

Core Curriculum (9-15 credits): This portion of the degree program is designed to provide a student with the background needed to establish a solid foundation in the program area over and above that obtained through undergraduate studies. Elective Curriculum (9-15 credits): This portion of the degree program is designed to allow each student to tailor his/her educational experience to meet individual research and educational objectives. Depending upon the program and the objectives, this may be met by added coursework or by additional research experience.

Research/Capstone Experience (12 credits): The details of this portion of the degree program are uniquely determined by the student and his/her advisor and will involve a combination of research and other capstone experiences that build on the knowledge gained in coursework.

Satisfactory participation in KAUST’s Summer Session’s and Winter Enrichment Program (WEP) are mandatory.

Summer Session courses are credit bearing and apply toward the degree.

WEP courses do not earn credit towards the degree.

At least thirty-six (36) degree credits must be completed in graduate-level courses and research projects. These courses should be 200-level or above and must be approved by the student’s advisor. Additional non-credit bearing activities, such as graduate seminars, may be required by the Program. Details on the specific program expectations, as well as the difference between the thesis and non-thesis degree options can be found through the link in the Program Guide http://www.kaust.edu.sa/study.html

For a list of eligible faculty advisors, see: http://libguides.kaust.edu.sa/theses

### 7.1 Thesis Requirements
Students wishing to pursue a thesis as part of their M.S. degree, must identify a research advisor and must file for Thesis status.

The application for the thesis option is due to the Registrar’s Office by the ninth week of the student’s second semester at KAUST.

Criteria for Acceptance into the Master’s Degree with Thesis program.
Students should have a well-constructed thesis proposal that includes a time-line for completion.

The thesis proposal must be approved by the research advisor and the Dean of the Division.

In the case of an optional thesis program, the student should have a minimum GPA of 3.2 and at least 12 credit hours completed at the conclusion of the first semester and be registered in at least 12 credit hours during the second semester.

The research advisor must indicate that he/she endorses the thesis topic and scope of work and that it could reasonably be completed by the end of the third semester. Alternatively, the faculty member agrees to a longer time frame, not to exceed the end the fourth semester, and to cover the student and experimental costs that accrue during this period.

The student’s program of study should be structured such that the student may change to the M.S. without Thesis option and finish the degree by the end of the student’s third semester.

### MS Thesis Defense Committee
The MS Thesis Defense committee, which must be approved by the student’s Dean, must consist of at least three members, and typically includes no more than four members. At least two of the required members must be KAUST faculty. The Chair plus one additional faculty member must be affiliated with the student’s program. This membership can be summarized as:

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<thead>
<tr>
<th>Member</th>
<th>Role</th>
<th>Program Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chair</td>
<td>Within Program</td>
</tr>
<tr>
<td>2</td>
<td>Faculty</td>
<td>Within Program</td>
</tr>
<tr>
<td>3</td>
<td>Faculty or Approved Research Scientist</td>
<td>Outside Program</td>
</tr>
<tr>
<td>4</td>
<td>Additional Faculty</td>
<td>Inside or outside KAUST</td>
</tr>
</tbody>
</table>

#### Notes
- Members 1 – 3 are required. Member 4 are optional
- Co-chairs may serve as Member 2, 3 or 4, but may not be a Research Scientist
- Adjunct Professors and Professor Emeriti may retain their roles on current committees, but may not serve as chair on any new committees
- Professors of Practice and Research Professors may serve as Members 2, 3 or 4 depending upon their affiliation with the student’s program. They may also serve as co-chairs
- Visiting Professors may serve as Member 4

The student is responsible for scheduling the thesis defense date with his/her supervisor and committee members. It is advisable that the student submits a written copy of the thesis to the thesis committee members at least two (2) weeks prior the defense date.

### 7.2 Non-Thesis Option
Students wishing to pursue the Non Thesis options must complete a minimum of 6 credits of directed research credits (299) is required. Summer internship credits may be used to fulfill the research requirement provided that the summer internship is research-based. Summer internships are subject to approval by the student’s Academic Advisor.
Students must complete the remaining credits through one (1) or a combination of the options listed below:

Broadening Experience Courses: Courses that broaden a student’s M.S. experience.
Ph.D.-Level Courses: Courses numbered 300 or greater. Any course in the Ph.D. core requirements that is passed with a minimum grade of B– may be used towards meeting the core Ph.D. requirements of the program if the student chooses to continue for a Ph.D. degree in KAUST.
Internship: Research-based summer internship (295). Students are only allowed to take one (1) internship.

It should be noted that a student may also combine courses to satisfy the Six (6)-credit requirement. For example, a student could take one (1) Ph.D.-level course and one (1) graduate-level course in another program. A student may not enrol in two (2) summer internships.


For a list of eligible faculty advisors, see: http://www.kaust.edu.sa/faculty-advisors.html

Students may select a KAUST faculty member from another program to act as a research advisor (for either thesis or directed research), but must provide a one (1)-page description of the research and an explanation of how such research would be relevant to the degree program. Upon approval by the program and the Dean, the faculty member would be allowed to act as an affiliated faculty member and advisor for the student.

Please Note: Degree Programs may have additional requirement to those listed above.

8. Ph.D. Program

Admissions
Ph.D. students apply for and enter a specific degree program. A faculty advisor is either immediately designated (in the case of a student being recruited by a specific faculty member) or temporarily assigned; in the latter case, the student is expected to identify a research advisor by (at the latest) the end of the first year.

There are three (3) phases and associated milestones for Ph.D. students:

- Passing a qualifying exam;
- Passing an oral defence of the dissertation proposal
- Dissertation phase with a final defense milestone.

8.1 Ph.D. Degree Requirements
There is a minimum residency requirement (enrolment period at KAUST) of 2.5 years for students entering with an M.S. degree, 3.5 years for students entering with a B.S. degree. Qualification and advancement to candidacy are contingent upon: (i) successfully passing Ph.D. coursework, (ii) designating a research advisor, (iii) successfully passing a qualifying exam, and (iii) writing and orally defending a research proposal. Possible outcomes include pass, failure with complete retake, failures with partial retake, and failure with no retake. Students not permitted to retake the exam, or who fail the retake, will be dismissed from the University. The maximum allotted time for advancement to candidacy for a student entering with a M.S. degree is two (2) years; three (3) years for students entering with a B.S.

Satisfactory participation in KAUST's Summer Session and Winter Enrichment Period (WEP) is mandatory. Summer Session courses are credit bearing and apply toward the degree. WEP courses do not earn credit towards the degree.

The required coursework is outlined below and see program for specific program course requirements:

M.S. Degree
- Core courses
- Elective courses

Ph.D. Degree
- Two (2) or more courses at the 300 level
- Graduate seminar if required by the program.

Students entering the program with a relevant M.S. from another institution may transfer coursework toward the requirements of the M.S. degree listed above upon approval of the program.

Students entering the program with a M.S. from KAUST may transfer coursework toward both the M.S. and Ph.D. requirements listed above upon approval of the program and based on their program of study at KAUST.

Students entering with a B.S. from another institution may transfer in up to 9 credits of graduate level coursework towards the above requirements upon approval of the program. In addition, students entering with a B.S. may also qualify to earn a M.S. degree by satisfying the M.S. degree requirements as part of the Ph.D. program.

Some degree programs may require a diagnostic entrance exam as a basis for admission, and students may be required to complete additional coursework depending on their degree-granting institution. If the M.S. degree is from a subject other than the Ph.D. degree program, there may be additional courses required and specified by the advisor.

8.2 Candidacy
Achieving Ph.D. candidacy is contingent upon successfully passing a qualifying examination, acceptance by the research advisor of a written research proposal and successfully passing an oral examination. Details should be confirmed in the individual degree program material. For a list of eligible faculty advisors for any degree program see: http://www.kaust.edu.sa/faculty-advisors.html

Passing the qualification phase is achieved by acceptance of all committee members of the written proposal and a positive
vote of all but, at most, one (1) member of the oral exam committee. If more than one (1) member casts a negative vote, one (1) retake of the oral defense is permitted if the entire committee agrees. A conditional pass involves conditions (e.g., another course in a perceived area of weakness) imposed by the committee, with the conditional status removed when those conditions have been met. Once constituted, the composition of the qualification phase committee can only be changed upon approval by both the faculty research advisor and the division dean.

8.3 Dissertation Research Credits
Besides coursework (6 or more credit hours), dissertation research (course number 397) must be earned during the first (proposal preparation and defense) and second phases of the Ph.D. program. A full-time workload for Ph.D. students is considered to be 12 credit hours per semester (courses and 397) and 6 credit hours in summer (397 only). There is a minimum residency requirement (enrolment period at KAUST) of 2.5 years for students entering with an M.S. degree, 3.5 years for students entering with a B.S. degree. Ph.D. students typically complete the degree in 5 years.

8.4 Dissertation and Dissertation Defense

8.4.1 Dissertation Defense
The PhD Dissertation Defense Committee

The result of the defense will be made based on the recommendation of the committee. There are four (4) possible results: (1) Pass: the student passes the exam and the dissertation is accepted as submitted; (2) Pass with 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) 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 (6) months from the date of the first defense; and (4) 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. PhD Dissertation Defense Committee

The PhD Dissertation Defense committee, which must be approved by the student’s Dean, must consist of at least four members, and typically includes no more than six members. At least three of the required members must be KAUST faculty and one must be an examiner who is external to KAUST. The Chair plus one additional faculty member must be affiliated with the student’s program. The external examiner, is not required to attend the defense, but must write a report on the dissertation and may attend the dissertation defense at the discretion of the Program. This membership can be summarized as:

<table>
<thead>
<tr>
<th>Member Role</th>
<th>Program Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Chair</td>
<td>Within Program</td>
</tr>
<tr>
<td>2 Faculty</td>
<td>Within Program</td>
</tr>
<tr>
<td>3 Faculty</td>
<td>Outside Program</td>
</tr>
<tr>
<td>4 External Examiner</td>
<td>Outside KAUST</td>
</tr>
<tr>
<td>5 Approved Research Scientist</td>
<td>Inside KAUST</td>
</tr>
<tr>
<td>6 Additional Faculty</td>
<td>Inside or outside KAUST</td>
</tr>
</tbody>
</table>

Notes
- Members 1 – 4 are required. Members 5 and 6 are optional
- Co-chairs may serve as either Member 2, 3 or 6
- Adjunct Professors and Professor Emeriti may retain their roles on current committees, but may not serve as chair on any new committees
- Professors of Practice and Research Professors may serve as Members 2, 3 or 6 depending upon their affiliation with the student’s program. They may also serve as co-chairs
- Visiting Professors may serve as Member 6, but not as the external examiner

It is the responsibility of the student to inform the dissertation committee of his/her progress and meet deadlines for submitting defense date and graduation forms. It is expected that students will submit their dissertations to their committee six (6) weeks prior to the defense date in order to receive feedback from the committee members in a timely manner. However, the advisor may approve exceptions to this expected timeline. The dissertation format requirements are described in the KAUST Thesis and Dissertation Guidelines. http://libguides.kaust.edu.sa/theses

9. Program Descriptions

The Master’s and Doctoral degree program requirements listed above represent general university-level expectations. The specific details of each degree requirements are outlined in the descriptions of the individual degree programs.

9.1 Course Notation

Each course is listed prefaced with its unique number and post fixed with (l-c-r) where:
- l is the lecture hours, to count toward fulfilling the student workload during a semester.
- c is the recitation or laboratory hours.
- r is the credit hours toward fulfilling a degree course requirement.

Eg CS 220 Data Analytics (3-0-3) has a total of three (3) hours of lectures per week, has no labs and earns 3 credits for the semester

9.2 Grading

The KAUST grading system is a 4.0 scale utilizing letter grades, and these are the only grades that will be assigned.
<table>
<thead>
<tr>
<th>Grade</th>
<th>GPA</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.00</td>
<td>Good Standing</td>
</tr>
<tr>
<td>A-</td>
<td>3.67</td>
<td>Academic Notice</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
<td>Academic Probation</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>B-</td>
<td>2.67</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>C+</td>
<td>2.33</td>
<td>GPA Standing less two (2) categories</td>
</tr>
<tr>
<td>C</td>
<td>2.00</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>C-</td>
<td>1.67</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>D+</td>
<td>1.33</td>
<td>GPA Standing less two (2) categories</td>
</tr>
<tr>
<td>D</td>
<td>1.00</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>D-</td>
<td>0.67</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>F</td>
<td>0.00</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>Incomplete</td>
</tr>
<tr>
<td>IP</td>
<td></td>
<td>In Progress</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>Withdrew</td>
</tr>
<tr>
<td>S</td>
<td></td>
<td>Satisfactory</td>
</tr>
<tr>
<td>U</td>
<td></td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>WF</td>
<td></td>
<td>Withdrew-Failed</td>
</tr>
</tbody>
</table>

### 10.1 Incomplete Grades
Students who complete the majority of the requirements for a course but are unable to finish the course may receive an incomplete (I) grade. A grade of Incomplete will be assigned only with the consent of the instructor of the course after the instructor and the student have agreed on the academic work that needs to be completed and the date it is due (but no later than the end of the second week of the following semester or session). When the requirements for the course are completed, the instructor will submit a grade that will replace the incomplete grade on the student's academic record. Incompletes not completed by the end of the second week of the following semester or session will be changed to F (failing) grades.

Grades for students that are due to graduate
Note that any incomplete grades (as well as fail grades) will mean a student will not graduate or receive a diploma during the Commencement ceremony.

Incomplete grades are granted to individual students on a case-by-case basis. Incomplete grades should not be used as a mechanism to extend the course past the end of the semester.

Students are allowed only one (1) incomplete grade while in a degree program at KAUST.

### 10.2 In Progress (IP) grade
Thesis Research (297) or Dissertation Research (397) should be graded as IP (In Progress), S (satisfactory) or U (unsatisfactory) for each semester.

(These IP grades will be converted by the Registrar’s Office to “S” grades for all semesters, once the Office has notified that the thesis or dissertation has been submitted to the Library)

### 10.3 Research or Seminar courses
Use the following grades for these research or seminar courses:
- 297 Thesis Research Either IP or U
- 397 Dissertation Research Either IP or U
- 295/395 Internship(summer) Either S or U
- 298/398 Seminar Either S or U
- 299/399 Directed Research Either S or U

### 10.4 Cumulative Grade Point Average
A minimum GPA of 3.0 must be achieved in all coursework. Individual courses require a minimum of a B- for course credit.

A student’s academic standing is based on his/her cumulative performance assessment and a semester performance based on the number of credits earned and GPA during the most recently completed semester.

### 10.5 Academic Standing
Academic standing classifications are divided into four (4) categories of decreasing levels of academic performance: (1) Good Standing; (2) Academic Notice; (3) Academic Probation; and (4) Academic Dismissal.

#### Cumulative Assessment
<table>
<thead>
<tr>
<th>GPA</th>
<th>Academic standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.00 – 4.00</td>
<td>Good Standing</td>
</tr>
<tr>
<td>2.67 – 2.99</td>
<td>Academic Notice</td>
</tr>
<tr>
<td>2.33 – 2.66</td>
<td>Academic Probation</td>
</tr>
<tr>
<td>Below 2.33</td>
<td>Academic Dismissal</td>
</tr>
</tbody>
</table>

#### S/U Performance Academic Standing
<table>
<thead>
<tr>
<th>Credits</th>
<th>Academic standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2 credits</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>3 – 5 credits</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>6 – 8 credits</td>
<td>GPA Standing less two (2) categories</td>
</tr>
<tr>
<td>9+ credits</td>
<td>Academic Dismissal</td>
</tr>
</tbody>
</table>

#### Semester Assessment
Registered in 12 credits
<table>
<thead>
<tr>
<th>Credits Earned</th>
<th>Academic standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>12+credits</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>9-11credits</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>6- 8 credits</td>
<td>GPA Standing less two (2) category</td>
</tr>
<tr>
<td>0- 5 credits</td>
<td>Academic Dismissal</td>
</tr>
</tbody>
</table>

#### Summer Session Assessment
<table>
<thead>
<tr>
<th>Credits Earned</th>
<th>Academic standing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 credits</td>
<td>GPA Standing</td>
</tr>
<tr>
<td>3 – 5 credits</td>
<td>GPA Standing less one (1) category</td>
</tr>
<tr>
<td>0 – 2 credits</td>
<td>GPA Standing less two (2) categories</td>
</tr>
</tbody>
</table>

### Definitions
Good Standing:
Student is making satisfactory academic progress toward the degree.

Summer Session and Winter Enrichment Program
Satisfactory participation in KAUST’s Summer Session and Winter Enrichment Period (WEP) is mandatory. Summer Session courses are credit bearing and apply toward the degree. WEP courses do not earn credit towards the degree.
11. Transferring Credits
A student may petition to transfer graduate credits from another university, upon approval of the Program Chair and the Registrar. Each student’s application will be reviewed on a case-by-case basis. The following rules apply:
Up to three (3) graduate-level courses not to exceed nine credits may be transferred for credit. Courses transferred for credit cannot have been counted as credits for another granted degree. The course grade for any course to be transferred must be a B or above.
Courses transferred for degree credit must have been taken within three (3) years prior to admission to KAUST.

Academic Notice:
Student is not making satisfactory progress toward the degree. A student placed on Academic Notice will be monitored in subsequent semesters to ensure satisfactory progress toward the degree (see Good Standing). If the student’s performance does not improve in the following semester, the student will be placed on academic probation.

Academic Probation
Student is not making satisfactory progress toward the degree. A student placed on Academic Probation will be monitored in subsequent semesters to ensure satisfactory progress toward the degree (see Good Standing). If the student’s performance does not improve in the following semester, the student will be academically dismissed.

Academic Dismissal
Student is not making satisfactory progress toward the degree and is unlikely to meet degree requirements. Dismissed students will be required to leave the University. If deemed eligible, dismissed students will have one (1) week from receiving notice of dismissal to file an appeal.

Appeal Process for Students Academically Dismissed
If the student is eligible to appeal, he/she must submit a written explanation why the dismissal should be rescinded along with any supporting documentation. The Committee on Academic Performance will hear the appeal and make a decision to grant or deny the appeal based on the appeal and documentation, the student’s past performance, and the likelihood that the student is capable of successfully completing his/her academic program. If the appeal is denied, the student will be required to leave the University. The decision of the Committee is final; no additional appeals are permitted.

S/U Protection
Due to the significant impact of U grades, a faculty member giving a U grade for a course involving 6 or more credits must obtain concurrence of the Dean prior to submitting the grade. If the grade is given for only a single class (including research credit) the number of credits will be capped at 6 when using the academic standing table displayed above.

Returning to Good Standing
A student not in good standing due to a GPA deficiency may return to Good Standing by improving his/her cumulative GPA such that it meets or exceeds 3.00. A student not in good standing due to U grades may return to Good Standing by completing at least 12 credits during the subsequent semester with no U grades and a semester GPA of at least 3.00 in traditionally graded courses.

12. Policy for Adding and Dropping Courses
A course may be added during the first week of the semester. Students may add courses after the first week with the permission of the instructor. Instructors have the right to refuse admission to a student if the instructor feels that the student will not have the time to sufficiently master the material due to adding the course. A course may be dropped without penalty at any time during the first two (2) weeks of the semester. Between the second and ninth week, students can drop a course but the course will appear on the student’s transcript with the grade of “W” (withdraw). After the ninth week of a full semester, courses may be dropped only under exceptional circumstances and with the approval of the Course Instructor, the Program Chair and the Registrar.

13. Program Planning
It is the sole responsibility of the student to plan her/his graduate program in consultation with her/his advisor. Students are required to meet all deadlines. Students should be aware that most core courses are offered only once per year.