Smart man-engineered environment is no longer the realm of science fiction. We are surrounded by intelligent machines that follow our algorithms and improve the quality of our life. We predict highly complex natural phenomena, such as climate, with mathematical models of ever increasing accuracy. We use our understanding, translated in the form of mathematical computations, to design novel materials and to optimize important processes that help us resolve big issues such as availability of clean water and energy. Computer, Electrical and Mathematical Sciences and Engineering (CEMSE) are cornerstones of modern life, they help us ensure the continuity and sufficiency of the supply of water, food, energy in a sustainable environment; they drive our industrial production lines, they give us new materials for upcoming technologies and better healthcare. This is what the CEMSE division is for and in this context this division aims to drive frontier science and train the next generation of scientists as heirs of wisdom and carriers of future progress.

The CEMSE division is the home of three degree-granting programs: Applied Mathematics & Computational Science, Computer Science, and Electrical Engineering. Besides attending lectures and seminars, the students in the CEMSE division have the opportunity to conduct research in the framework of directed research, MS thesis, and PhD dissertation.

Research at CEMSE takes advantage of the superb KAUST resources and facilities to bring students, research staff, and faculty together to push the frontiers of science through collaborative inquiry into issues of regional and global significance. More specifically, the CEMSE division is associated with three of KAUST’s Research Centers: the Computational Bioscience Research Center, the Extreme Computing Center, and the Visual Computing Research Center. In addition, the CEMSE students, researchers, and faculty have unparalleled access to a large collection of best-in-class research laboratories and cutting-edge facilities hosted in the Shaheen Supercomputer, the CORNEA Visualization Center, and the Advanced Nanofabrication Imaging and Characterization.

In summary, the CEMSE division plays a central role in the research, teaching, and outreach of KAUST both because its intellectual domains are evolving rapidly and powerfully at their frontiers.

Mootaz Elnozahy, Dean
Computer, Electrical, and Mathematical Science and Engineering (CEMSE) Division
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1. Aims and Scope
The Computer Science program educates students to become world-class researchers and thought leaders in the field of computer science. The program is designed to prepare the student for a career in academia, industrial research or advanced positions in industry.

The program offers two (2) degrees: the Doctor of Philosophy (Ph.D.) degree and the M.S. degree (M.S.). The M.S. degree can be obtained by taking courses only or by a combination of courses and writing a thesis. Students who are interested in a research career are encouraged to apply directly to the Ph.D. program. An M.S. degree is not a pre-requisite to enroll in the Ph.D. program.

A student who completes the Ph.D. degree will have demonstrated original research that is published in world-class prestigious conferences, journals, and other research forums. This degree is appropriate for those who want to pursue a career in research either in academia or industry.

A student who completes the M.S. degree by taking courses and writing a thesis will have demonstrated ability to perform directed research and complete a research project. This degree is appropriate for students who wish to pursue a Ph.D. degree later.

A student who completes the M.S. degree by taking only courses will have demonstrated strong performance in graduate-level courses that prepare the student for a career of advanced research and development in industry.

The scope of research in the Computer Science program at KAUST includes the following areas:

- Artificial Intelligence and Machine Learning
- Computational Biosciences
- Computer Systems and Databases
- High Performance Computing
- Theoretical Computer Science
- Visual Computing

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 student, all incoming students will take a placement test in the orientation week. There is no grade for the examination, and there is no passing or failing. The purpose of the examination is to determine the gaps that may impede a student from successful completion of the degree requirements so that they can be addressed in the study plan. The advisor uses the results of the tests to design the list of courses that would lead to a degree (the study plan). Students are encouraged to prepare for the examination by refreshing their general knowledge that they gained from their undergraduate education before arrival on campus.

3. Masters Degree.
The 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: Listed below. The M.S. degree is awarded upon successful completion of a minimum of 36 credits.

Core 12 credits from the CS Master’s Course requirements list.

Elective 12 credits selected from graduate courses at the 200 or 300 levels except CS297 and CS397. These courses can be from outside the program, subject to the approval of the advisor and program.

Research
Some courses enable students to engage in research, such as Directed Research (CS299) where a student performs research under the supervision of a CS faculty member. Students also can earn up to a maximum of six (6) credits by enrolling in research-based summer internships (CS295). Summer internships are subject to approval by the student’s Academic Advisor and the program.

Satisfactory completion of at least one (1) Winter Enrichment Program (WEP) is required of all M.S. students as part of completion of the degree requirements. Ph.D. students who did not receive their M.S. degree at KAUST are also required to satisfactorily complete at least one (1) WEP.

All Master students must register for CS 298 (non-credit seminar course) during the first semester of their studies at KAUST. All Master students must attend at least 6 seminars from the “Computer Science Seminar Series”, during every spring and fall semester for the entire duration of their studies. Graduation with an M.S. degree in CS requires an average GPA of 3.0; a minimum grade of B- or better is required in all courses presented for the degree.

3.1. Master’s Course Requirements
Core Courses
Students enrolled toward the M.S. degree is required to complete the following four (4) core courses:

- CS 220 Data Analytics
- CS 240 Computing Systems and Concurrency
- CS 260 Design and Analysis of Algorithms
- CS 280 High Performance Computing and Architecture

The core courses are designed to cover the basic skills and competence that are expected off any student holding an advanced degree.

Course Listing by Area

Artificial Intelligence and Machine Learning
CS 220 Data Analytics [Core Course]
AMCS 212 Linear and Nonlinear Optimization
CS 229 Machine Learning
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 245</td>
<td>Databases</td>
</tr>
<tr>
<td>CS 290A</td>
<td>Special Topics: Knowledge Representation and Reasoning</td>
</tr>
<tr>
<td>CS 340</td>
<td>Computational Methods in Data Mining</td>
</tr>
<tr>
<td>CS 341</td>
<td>Advance Topics in Data Management</td>
</tr>
<tr>
<td>CS 361</td>
<td>Combinatorial Machine Learning</td>
</tr>
<tr>
<td>CS 32</td>
<td>Probabilistic Graphical Models</td>
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</tbody>
</table>

### Computational Biosciences

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>B 204</td>
<td>Genomics</td>
</tr>
<tr>
<td>B 205</td>
<td>Protein Structure and Function</td>
</tr>
<tr>
<td>B 224</td>
<td>Fundamentals of Cell Biology</td>
</tr>
<tr>
<td>CS 321</td>
<td>Applications of AI in Bioinformatics</td>
</tr>
<tr>
<td>CS 340</td>
<td>Computational Methods in Data Mining</td>
</tr>
<tr>
<td>CS 361</td>
<td>Combinatorial Machine Learning</td>
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### Computer Systems

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CS 140</td>
<td>Systems Programming and Architecture</td>
</tr>
<tr>
<td>CS 142</td>
<td>Programming (C++)</td>
</tr>
<tr>
<td>CS 240</td>
<td>Computing Systems and Concurrency</td>
</tr>
<tr>
<td>CS 244</td>
<td>Computer Networks</td>
</tr>
<tr>
<td>CS 245</td>
<td>Databases</td>
</tr>
<tr>
<td>CS 341</td>
<td>Advanced Topics in Data Management</td>
</tr>
<tr>
<td>CS 344</td>
<td>Advanced Topics in Computer Networks</td>
</tr>
<tr>
<td>CS 346</td>
<td>Advanced Topics in Operating Systems</td>
</tr>
<tr>
<td>CS 348</td>
<td>Cloud Computing I</td>
</tr>
<tr>
<td>CS 380</td>
<td>GPU and GPGPU Programming</td>
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### High Performance Computing

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CS 280</td>
<td>High Performance Computing and Architecture [Core Course]</td>
</tr>
<tr>
<td>CS 291</td>
<td>Scientific Software Engineering</td>
</tr>
<tr>
<td>CS 292</td>
<td>Parallel Programming Paradigms</td>
</tr>
<tr>
<td>AMCS 311</td>
<td>High Performance Computing I</td>
</tr>
<tr>
<td>AMCS 31</td>
<td>High Performance Computing II</td>
</tr>
<tr>
<td>CS 380</td>
<td>GPU and GPGPU Programming</td>
</tr>
</tbody>
</table>

### Theoretical Computer Science

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CS 160</td>
<td>Data Structure and Algorithms</td>
</tr>
<tr>
<td>CS 161</td>
<td>Theory of Computer Science</td>
</tr>
<tr>
<td>CS 212</td>
<td>Linear and Nonlinear Optimization</td>
</tr>
<tr>
<td>CS 229</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>CS 260</td>
<td>Design and Analysis of Algorithms [Core Course]</td>
</tr>
<tr>
<td>CS 261</td>
<td>Combinatorial Optimization</td>
</tr>
<tr>
<td>CS 361</td>
<td>Combinatorial Machine Learning</td>
</tr>
<tr>
<td>CS 337</td>
<td>Information Networks</td>
</tr>
<tr>
<td>CS 372</td>
<td>Computational Geometry</td>
</tr>
<tr>
<td>CS 360</td>
<td>Computational Complexity</td>
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### Visual Computing

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CS 248</td>
<td>Computer Graphics</td>
</tr>
<tr>
<td>CS 247</td>
<td>Scientific Visualization</td>
</tr>
<tr>
<td>CS 272</td>
<td>Geometric Modeling</td>
</tr>
<tr>
<td>AMCS 271</td>
<td>Applied Geometry</td>
</tr>
<tr>
<td>CS 380</td>
<td>GPU and GPGPU Programming</td>
</tr>
<tr>
<td>EE/AMCS 396</td>
<td>Mathematical Modeling in Computer Vision</td>
</tr>
<tr>
<td>CS 390</td>
<td>Special Topics: Computational Imaging and Display</td>
</tr>
</tbody>
</table>

### Interdisciplinary Research and Studies

Inter-disciplinary research and studies are encouraged. Students in Computer Science often enroll in courses in Applied Mathematics and Computational Sciences, Biology, Electrical Engineering, Mechanical Engineering, and Statistics. With computing becoming part and parcel of the fabric of many other fields, we would like to enable KAUST students to be at the forefront of the new trends in science. Therefore, the study plan of a student may contain courses from outside the program list, including outside those in Section “Course Listing by area” All study plans are subject to the approval of the advisor and the program.

Balancing breadth and depth is always a delicate endeavour. The Computer Science program aims at preparing students to be competent computer scientists who are well versed in their core areas, but also who can apply their science to other fields. When faced with a conflict between depth and breadth, the program will ensure first that depth requirements are met before allowing breadth courses from outside the program other than those listed in Section “Course Listing by area”

### Research Courses

#### Master-level Research

- CS 297 Master Thesis Research
- CS 298 Master Graduate Seminar
- CS 299 Master Directed Research

#### Doctoral-level Research

- CS 397 Doctoral Dissertation Research
- CS 398 Doctoral Graduate Seminar
- CS 399 Doctoral Directed Research

Note: Several courses are cross-listed in the Applied Mathematical and Computational Science (AMCS) or Electrical Engineering (EE) program. Also, there are several courses offered by both programs that Computer Science students can enroll in toward fulfilling their course requirements. Below is the list of courses that the CS program offers. Students should consult the course listings of other programs for the specific details and prerequisite for each course.

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

Not all courses are offered every year. Students should consult the Graduate Program Coordinator or the Associate Dean for the timing of offering of a particular course of interest.
3.2 Thesis Option
Student’s must fulfil the following requirements:

- Secure a member of the faculty who is will supervise their research. The thesis option is not guaranteed to every student.
- Earn a minimum of 12 credits of M.S. Thesis Research (CS 297). Students are permitted to register for more than 12 credits of M.S. thesis research as necessary with the permission of the thesis advisor.
- Fulfil the M.S. Degree General Requirements
- Write and successfully defend an M.S. thesis in a public seminar.

The student must form a M.S. 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>
</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 advisor and committee members. The student must inform their Graduate Program Coordinator on their intent to defend one (1) month prior to the defense date, and must submit a written copy of the thesis to the thesis committee members at least one (1) month prior to the defense date. The student must present the results of the thesis research at an announced division-based seminar, which has to be communicated to his Graduate Program Coordinator.

3.3 Non-Thesis Option
In addition to the 24 credits of actual core/elective coursework, an additional 12 credits of course embodying research experience and broadening experience are required, selected from the following areas –

Directed Research (code 299)
Internship: Research based summer internship (295)

A student may not enroll in more than one (1) internships for credit Broadening Experience Courses can be selected from Ph.D. level courses (courses numbered 300 or above) or Internship Research

Upon entry to the program, students will be assigned a Faculty Course Advisor. When a student decides upon a specific track, typically after the first semester & before the start of the second semester, he/she will be transferred to a faculty track coordinator for further advice. If a student transitions to a Master with Thesis option, the Faculty Research Advisor also serves the role of coursework advisor. Student coursework progress towards the M.S. Degree will be monitored through a standard advising form updated each semester.

Non Thesis student need to fulfill the M.S. General Requirements and earn an additional 12 credits from graduate courses at the 200 or 300 levels. These can include courses from outside the program, subject to the approval of the advisor and program.

4. Doctor of Philosophy
All Ph.D students must register for CS 398 (non-credit seminar course) for the first semester of their studies at KAUST.

Following that, all Ph.D. students must attend at least 6 seminars from the “Computer Science Seminar Series”, during every spring and fall semester for the entire duration of their studies.

In accordance with KAUST regulations, a student admitted to the Ph.D. program is designated a Ph.D. Student and later as a Ph.D. Candidate upon successful completion of candidacy requirement outlined below. 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. A minimum GPA of 3.0 must be achieved on all doctoral coursework.

The Ph.D. program includes the following requirements:

Successful completion of Ph.D. coursework;
Designating a research advisor;
- Passing a subject qualifying examination;
- Passing a proposal defense and obtaining candidacy status.
- Preparing, submitting and successfully defending a doctoral dissertation.
### 4.1 Ph.D. Course Requirements

For students who enter the Ph.D. program with an M.S. degree, they need to complete 6 credit hours of 300-level courses.

- Enroll in the Winter Enrichment Program at KAUST at least once.
- Fulfill the Ph.D. seminar requirement.
- Complete the Ph.D. qualification examination.
- Submit an annual progress report each year.
- Complete the Ph.D. research proposal examination.
- Fulfill the Ph.D. publication requirement.
- Submit a dissertation, which embodies the candidate’s original scholarly work.
- Pass a dissertation defense oral examination.
- Doctoral Seminar Requirement
  - All Ph.D. students must register for CS 398 (non-credit seminar course) for the first semester of their studies at KAUST.

Following that, all Ph.D. students must attend at least 6 seminars from the “Computer Science Seminar Series”, during every spring and fall semester for the entire duration of their studies.

#### 4.2 Designation Of Advisor

Upon arriving to the campus, students enroll in an orientation week managed by the university. During the orientation week, each student is expected to meet with his or her faculty advisor. Each student is initially assigned to a faculty advisor regardless of degree. For students enrolled toward the Ph.D. degree, the advisor is the same as the application sponsor and the Ph.D. dissertation advisor. The advisor is responsible for designing a study plan toward the respective degree. The study plan is presented to the program and must be approved by a committee consisting of the associate dean of education, the program chairs and the dean (or designee).

After the first semester of registration, the student may elect to switch to a different faculty advisor (with the approvals of the faculty involved and the program). Students also have the opportunity to select two (2) co-advisors. The advisor has to be a Computer Science faculty member or an affiliated member from another program.

#### 4.3 Qualification Phase

The qualifying exam consists of three (3) written subject examinations in the following three (3) courses: CS260 (Design and Analysis of Algorithms), CS240 (Computer Systems and Concurrency), CS220 (Artificial Intelligence, Machine Learning, and Data Analytics).

The qualifying examination is given twice a year, during the final examinations of the Fall and Spring semesters, respectively.

The Ph.D. qualification examination will be the Final Examination of each of the above courses given during the Fall semester. It will also be a three (3) hours examination per subject (similar to the Fall semester) prepared by the faculty during the Spring semester. The qualification examination will be consistent. Therefore, it will span over two (2) days during the Spring semester. M.S. students who pass the three (3) examinations (in the same semester) are also considered to have passed the Ph.D. qualification examination.

- Three (3) Passes a straight Pass.
- Three (3) or Two (2) Fails a straight Fail.
- Two (2) Passes and One (1) Fail require a decision by a committee.

Students who fail must retake the entire examination during the final examination period of the next semester when the qualifying examinations are offered for their second and final chance. If they fail the second attempt, they will not be permitted to continue their Ph.D. program. No partial pass is permitted. Students who fail the examination must retake the three (3) subject examinations even if they previously passed a part of them. No subject waving or change is permitted.

### 4.4 Ph.D. Proposal Defense Committee

Each student is expected to identify a research advisor by the end of the first year of the program. Optionally, students may select two (2) co-supervisors. The supervisor or at least one (1) of the co-supervisors must have a permanent academic faculty-level appointment.

#### Ph.D. Proposal Defense Committee

- The Proposal Defense Committee must include the following members:
  - First member/Supervisor/Chair: Full time KAUST faculty member (within the student’s degree program)
  - Second member: Full time KAUST faculty member (within the student’s degree program)
  - Third member: Full time KAUST faculty member (from another degree program)

The research proposal exam must be taken within one (1) year after passing the qualifying exam and is administered by the student’s research advisory committee. The research proposal exam tests the student’s preparedness to pursue dissertation research. It is a public oral presentation of a research proposal, together with questioning by the advisory committee. The student must submit a written research proposal to the committee at least two (2) weeks prior to the exam. The examination is based on the submitted proposal, but the committee also may ask questions of a more general nature in order to test the adequacy of the student’s preparation for the proposed research.

The advisory committee consists of a minimum of three
(3) KAUST faculty members, one (1) of whom must be external to the degree program. The candidate must convince the committee that the chosen research area is suitable and demonstrate an appropriate breadth of knowledge in the chosen area. The committee should decide if there is a thesis topic in the area and whether the candidate is capable of completing such a thesis. There are four (4) possible outcomes:

- **Pass**: The student passes the exam and may proceed to undertake study and research for the doctoral degree. The “pass” decision is achieved by the unanimous vote of the committee.
- **Conditional Pass**: The student’s proposal or preparation contains some deficiencies. The student is required by the committee to complete additional preparation (coursework) and/or another individual oral exam. The conditional status is removed when the conditions have been met. A Pass must be obtained by the end of the following semester.
- **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.
- **Fail**: If the committee decides that the student is not capable of completing the degree with an original thesis in a reasonable amount of time, the student has failed the exam and will be dismissed from the program.

### 4.5 Dissertation Proposal Defense

The research proposal examination tests the student’s preparedness to pursue thesis research. It is an oral presentation of a research proposal together with questioning by the advisory committee. Students must inform their Graduate Program Coordinator on their intention to defend their proposal at least one (1) month prior to the set date.

The student submits a written research proposal to the advisory committee at least two (2) weeks prior to the oral presentation. The advisory committee consists of the advisor and two (2) faculty members from within the program as close to the proposed research area as possible. In certain cases, e.g. interdisciplinary research, the advisor may add additional committee members. The candidate must convince the committee that the chosen research area is suitable and demonstrate an appropriate breadth of knowledge in the chosen area. The committee should decide if the proposal constitutes an original thesis in the area and whether the candidate is capable of completing such a thesis. The committee decision can be:

- **Pass**: The student may proceed to work on the dissertation.
- **Pass with Conditions**: The student collects the committee feedback and attempts to correct deficiencies. The committee can request another informal/individual oral examination. A Pass must be obtained by the end of the following semester.
- **Fail**: The student is judged not capable of completing the degree with an original thesis in a reasonable amount of time

The committee reports the results to the student and to the division in writing.

### 4.6 Ph.D. Dissertation Defense

After successfully completing all coursework requirements, passing the qualifying examination, identifying an advisor, and forming a Dissertation Committee, a student gains candidacy status by presenting a doctoral research proposal and obtaining approval to pursue the proposed research from the Dissertation Committee.

To be eligible for the Ph.D. degree, students must pass three (3) exams:

- **Qualifying Exam**
- **Research Proposal Exam**
- **Final Defense**

#### Ph.D. Oral Defense

The student must schedule the final oral defense after completion of all other degree requirements including the doctoral research and writing of the dissertation. This examination will be a defense of the doctoral dissertation and a test of the candidate’s knowledge in the specialized field of research. The student must submit a copy of the dissertation at least two (2) months prior to the defense date.

The format of the examination will be a public seminar presented by the candidate. The date must be specified and announced by the Graduate program Coordinator at least two (2) months in advance. The public seminar ends with an open question period, followed by a private examination by the final examination committee.

The final defense is taken at least six (6) months (but no later than three (3) years) after the proposal defense and administered by the student’s research advisory committee. The student must schedule the final oral defense after completion of the doctoral research (including completion of at least 96 credit hours of a test of the candidate’s knowledge in the specialized field of research). The format of the exam is a public seminar presented by the candidate, with an open question period, followed by a private examination by the final examination committee. The only requirement for commonality with the proposal examination committee is the research advisor, although it is expected that other members will carry forward to the P.h.D. Dissertation Defense Committee.
The final examination committee shall consist, as a minimum, of the following members:

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:

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

In certain cases, e.g. interdisciplinary research, the advisor may add additional committee members. The only requirement for commonality with the proposal examination committee is the research advisor, although it is expected that other members will carry forward to the Dissertation Committee.

After the Oral Defense all committee members can vote for the following options:

- **Pass Unconditionally**: The dissertation is acceptable as it is. If all members vote likewise the student is deemed to have passed the defense.
- **Pass with Minor Revisions**: The dissertation requires minor revision. If all members vote “Pass Unconditionally” or “Pass With Minor Revisions”, the committee shall compile a list of the required revisions and communicate them to the candidate. The dissertation advisor will be responsible for ensuring that all minor revisions have been incorporated in the final dissertation.
- **Fail with Major Revisions**: The dissertation requires major revision and another oral defense. If one (1) or more members select this vote, and the other votes are “Pass Unconditionally or “Pass with Minor Revisions”, the committee shall compile a list of the required revision and communicate them to the candidate. A new oral defense is scheduled after the candidate incorporates all revisions. Only one (1) major revision is allowed.
  - **Fail The dissertation is unacceptable. If one (1) member selects this vote he or she will provide a written justification that is delivered to the candidate, the committee, and the dean. The issue is referred to the faculty of the program in a subsequent meeting who can either vote to retry the defense with a different committee or terminate the candidacy, in which case the student is terminated from the program.**

### 4.7 Annual Progress Reports

Progress reports must be filed at the end of each academic year by M.S. candidates under the dissertation option and by Ph.D. students. They are intended to assist the student to focus on making timely progress through the program requirements. To get the template of a progress report, please see your Graduate Program Coordinator. The entire faculty will review that report on a yearly basis. Students who are not performing at a satisfactory level may receive a warning letter with specific remedial actions. A period of six (6) months is given to remedy any deficiencies. Failure to address the problem may result in dismissal from the program.

### 5. Program Courses and Descriptions

#### CS 140. Systems Programming and Architecture (3-0-0)

This course provides a comprehensive and unified introduction to operating systems and concurrency control topics. It emphasizes both design issues and fundamental principles in contemporary systems and gives students a solid understanding of the key structures and mechanisms of operating systems. It also prepares the students to master concurrent and parallel programming by exposing the concepts of parallelism, synchronization and mutual exclusion. The course discusses design trade-offs and the practical decisions affecting design, performance and security. The course illustrates and reinforces design concepts and ties them to real-world design choices through the use of case studies.

#### CS 142. Programming (C++) (3-0-0)

This course is the same as CS207 but is restricted to CS students. The course covers computer programming and the use of abstractions; software engineering principles of data abstraction and modularity; object-oriented programming; fundamental data structures (such as stacks, queues, sets) and data-directed design. The course is designed for students who lack experience in imperative programming languages with explicit memory management. It covers also the practical implementation of concepts such as recursion; recursive data structures (linked lists, trees, graphs); and basic time and space complexity analysis. The course uses the C++ programming language as a vehicle and also covers the mechanics of C++.

#### CS 160. Data Structures and Algorithms. (3-0-0)

This course teaches techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics covered include: sorting; search trees; heaps; hashing; divide-and-conquer; dynamic programming; amortized analysis; graph algorithms; shortest paths; network flow; computational geometry; number-theoretic algorithms; polynomial and matrix calculations; caching; and parallel computing.
CS 161. Theory of Computer Science (3-0-0)
The course will progress through finite automata, circuits and decision trees, Turing machines and computability, efficient algorithms, reducibility, the P versus NP problem, NP-completeness, the power of randomness, and computational learning theory. It examines the classes of problems that can and cannot be solved by various kinds of machines. It tries to explain the key differences between computational models that affect their power.

CS 199. Directed Study in CS (3-0-0)
This course is a self-study in a particular topic directed by a faculty. Students do not register for this course. They may be required to enroll in it based on the recommendation of a faculty and approval of the program.

CS 207. Programming Methodology and Abstractions (3-0-3)
Computer programming and the use of abstractions. Object-oriented programming, fundamental data structures (such as stacks, queues, sets) and data-directed design. Recursion and recursive data structures (linked lists, trees, graphs). Introduction to basic time and space complexity analysis. The course teaches the mechanics of the C, C++ or Java language as well as an example of media library.

CS 220. Data Analytics (3-0-3)
Prerequisites: familiarity with algorithm runtime analysis (e.g., big O notations), probability theory (e.g. Gaussian distribution and conditional probability), and programming language (e.g., MATLAB or C++). The course covers basic concepts and algorithms for artificial intelligence, data mining and machine learning. The main contents are: artificial intelligence (task environment, performance measure, and problem solving by searching), data mining (data and patterns, summary statistics and visualization, unsupervised feature selection, and supervised feature selection), and machine learning (cross validation and supervised learning).

CS 229. Machine Learning (3-0-3)
Prerequisites: linear algebra and basic probability and statistics. Familiarity with artificial intelligence recommended. Topics: linear and non-linear regression, nonparametric methods, Bayesian methods, support vector machines, Artificial Neural Networks, model selection, learning theory, VC dimension, clustering, EM, dimensionality reduction, PCA, SVD, and reinforcement learning.

CS 240. Computing Systems and Concurrency (3-0-3)
Prerequisite: solid computer programming skills (at least at the level of CS 142). Operating systems design and implementation. Basic structure; synchronization and communication mechanisms; implementation of processes, process management, scheduling and protection; memory organization and management, including virtual memory; I/O device management, secondary storage and file systems. Concurrency at the hardware, programming language, and operating system level.

CS 241. Probability and Random Process (3-0-3)
Prerequisites: Advanced and multivariate calculus. Introduction to probability and random processes. Topics include probability axioms, sigma algebras, random vectors, expectation, probability distributions and densities, Poisson and Wiener processes, stationary processes, autocorrelation, spectral density, effects of filtering, linear least squares estimation and convergence of random sequences.

CS 244. Computer Networks (3-0-3)
Packet switching, Internet architecture, routing, router architecture, control algorithms, retransmission algorithms, congestion control, TCP/IP, detecting and recovering from errors, switching, Ethernet (wired and wireless) and local area networks, physical layers, clocking and synchronization. Assignments introduce network programming using NS-3, sockets, designing a router and implementing a transport layer. Also, advanced research papers on cloud computing, software define networking, and wireless sensor networks. The course consists of a final implementation project on a novel idea.

CS 245. Databases (3-0-3)
Prerequisites: working knowledge of basic discrete mathematics (e.g., sets, functions and relations) and programming skills. Database design and use of database management systems for applications. The relational model, relational algebra and SQL, the standard language for creating, querying and modifying relational and object-relational databases. XML data including the query languages XPath and XQuery. UML database design and relational design principles based on functional dependencies and normal forms. Other topics include indexes, views, transactions, concurrency, integrity constraints and triggers. Advanced topics from data warehousing, data mining, Web data management. Datalog, data integration, data streams and continuous queries and data-intensive Web services.

CS 247. Scientific Visualization (3-0-3)
Recommended prerequisites: Linear algebra, basic calculus, C/C++ programming experience. Recommended additional prerequisites: AMCS/CS 248 Computer Graphics, CS 380 GPU and GPGPU Programming, OpenGL programming experience. This course covers the basics and applications of scientific visualization. It covers techniques for generating images and interactive visualizations of various types of experimentally measured, computer-generated (simulated), or gathered data. It covers grid structures, scalar field and volume visualization, vector field and flow visualization, and tensor field visualization. It covers applications in science, engineering, and medicine.

CS 248. Computer Graphics (3-0-3)
Prerequisites: solid programming skills and linear algebra. Input and display devices, scan conversion of geometric primitives, 2D and 3D geometric transformations, clipping and windowing, scene modeling and animation, algorithms for visible surface determination, local and global shading models, color and real-time rendering methods.

CS 260. Design and Analysis of Algorithms (3-0-3)
Prerequisites: computer programming skills, probability, basic data structures and algorithms, basic discrete mathematics
The course covers main approaches to design and analysis of algorithms including important algorithms and data structures, and results in complexity and computability. The main contents are: review of algorithm analysis (search in ordered array, binary insertion sort, merge sort, worst-case and average-case time complexity, minimum complexity of sorting n elements for small n, 2-3 trees, asymptotic notation); divide and conquer algorithms (master theorem, integer multiplication, matrix multiplication, fast Fourier transform); graphs (breadth-first search, connected components, topological ordering, depth-first search, way from planar graphs to Robertson-Seymour theorem); dynamic programming (chain matrix multiplication, shortest paths, edit distance, sequence alignment, extensions of dynamic programming); greedy algorithms (binary heaps, Dijkstra’s algorithm, minimum spanning tree, Huffman codes, matroids).
randomized algorithms (selection, quick sort, global minimum cut, global minimum cut, cut, hushing); P and NP (Cook’s theorem, examples of NP-complete problems); approximate algorithms for NP-hard problems or polynomial algorithms for subproblems of NP-hard problems (set cover, vertex cover, maximum independent set, 2-SAT); partial recursive functions (theorem of Post, Diophantine equations); computations and undecidable problems (existence of complex problems, undecidability of halting problem, theorem of Rice, semantic and syntactical properties of programs).

CS 261 Combinatorial Optimization (3-0-3)
Prerequisite: familiarity with discrete algorithms at the level of AMCS 260
Topics: Maximum flow, minimum cut. Polytopes, linear programming, LP-relaxation, rounding. Greedy algorithms, matroids. Approximation algorithms for NP-complete problems. Randomized algorithms. These techniques are applied to combinatorial optimization problems such as matching, scheduling, traveling salesman, set cover, maximum satisfiability.

CS 272. Geometric Modeling (3-0-3)

CS 280. High Performance Computer Architecture (3-0-3)

CS 290 A: Special Topics: Knowledge Representation and Reasoning (3-0-3)
The course covers basic concepts in knowledge representation, reasoning, and its application in the Semantic Web. The aims of the course are to introduce key concepts of knowledge representation and its role in artificial intelligence, enable students to design knowledge-based systems, and understand limitations and complexity of algorithms for representing knowledge.

CS 291. Scientific Software Engineering (3-0-3)

CS 292. Parallel Programming Paradigms (3-0-3)
Prerequisites: programming experience and familiarity with basic discrete and numerical algorithms. Distributed and shared memory programming models and frameworks. Thread programming and OpenMP. Message passing and MPI. Parallel Global Address Space (PGAS) languages. Emerging languages for many core programming. Elements to be covered will include syntax and semantics, performance issues, thread safety and hybrid programming paradigms.

CS 297. Master Thesis Research (variable credit)
Master-level supervised research.

CS 298. Master Graduate Seminar (variable credit)
Master-level seminar focusing on special topics within the field.

CS 299. Master Directed Research (variable credit)
Directed research under the supervision of a faculty member.

CS 308. Stochastic Methods in Engineering (3-0-3)
Prerequisite: CS 241. Review of basic probability; Monte Carlo simulation; state space models and time series; parameter estimation, prediction and filtering; Markov chains and processes; stochastic control and stochastic differential equations. Examples from various engineering disciplines.

CS 320: Probabilistic Graphical Models (3-0-3)
Prerequisite: Students are expected to be familiar with probability theory, algorithms, machine learning and programming language.

This is a research-oriented graduate-level course on PGMs. The course will cover two (2) main types of PGMs, i.e., directed PGMs and undirected PGMs. For directed PGMs, we will cover Bayesian networks, with one (1) of its most important variants, hidden Markov models. For undirected PGMs, we will cover Markov networks (or Markov random fields), with one (1) of its most important variants, conditional random fields. Therefore, the course contains four (4) parts: Bayesian networks, hidden Markov models, Markov networks, and conditional random fields.

In each part, I will introduce motivations, ideas, definitions, examples, properties, representations, inference algorithms, and applications for the corresponding PGM. This is done through lectures by the instructor. In the next two (2) lectures, the students will present recommended research papers and lead in-class discussions. The last lecture of each part will be an in-class quiz, the purpose of which is not to judge their ability of calculation or memorization, but to push them to think more and deeper about the contents introduced in lectures. The course will finish by a final exam lecture and two (2) project presentation lectures. The projects are expected to be a real application or a serious theoretical work of PGMs on real research problems.

CS 321. Applications of AI in Bioinformatics (3-0-3)
Prerequisite: C/C++, HPC (parallel computing) programming experience

Recommended additional prerequisites: Course consists of selected projects. These projects cover application of AI to some of the relevant problems of analysis of large biological data and generally deal with complex information. Each year problems change. Students get assigned one (1) project and they work either alone or in groups of 2. Students in the interactive discussions with the whole class and the instructor solve the project problems. Students regularly present their progress and defend their approach and results in front of the whole class. During one (1) semester several types of topics are dealt with. Students get direct experience in research methodology, report writing, presentations and, most importantly, different ways of approaching solving AI problems.

CS 337. Information Networks (3-0-3)
Prerequisite: probability, stochastic systems, network architecture of the Internet and the systems performance Modeling, experimental design, performance measurement, model development, analytic modeling, single queue facility, networks of queues, stochastic systems, deterministic systems, birth-death model analysis, closed network model, bottleneck, interactive networks, M/M/m queues, M/G/1 priority queues, Markovian queuing model, random numbers, discrete event simulation, verification and validation of simulation models, workload characterization and benchmarks. Also, advanced research papers on using queuing theory for networking systems. The course consists of a final modeling and simulation project on a novel idea that leads to publication.

CS 340: Computational Methods in Data Mining
Prerequisites: Probability and Statistics, Linear Algebra, Artificial Intelligence. Focus is on both classical and new emerging techniques in data mining. Topics include computational methods in supervised and unsupervised learning, association mining, collaborative filtering and graph mining. Individual or group applications-oriented programming project is required.

CS 341: Advanced Topics in Data Management (3-0-3)
Prerequisites: CS 245. Topics in Data Management will be analyzed and discussed. Students will engage in research and project presentations. Topics will vary by semester.

CS 344: Advanced Topics in Computer Networks (3-0-3)
Prerequisites: solid computer networking background or CS244 computer networks, excellent skills in programming using C/C++, using network simulators such as NS-3, working with Linux systems. Topics in Computer Networks will be analyzed and discussed. Topics will vary by a semester.

CS 346: Advanced Topics in Operating Systems (3-0-3)
Prerequisites: Solid computer programming skills (at least at the level of CS 207) and solid background in at least one (1) operating systems (CS 240) or computer architecture (at least at the level of CS 209 or CS 280), or permission of instructor. Topics in Operating Systems will be analyzed and discussed. Topics will vary by semester.

CS 360: Computational Complexity (3-0-3)
Prerequisites: CS 260. This course covers the main complexity classes, as well as selected advanced topics in computational complexity. Topics: Hardness of Computational problems, models of computations including Turing machines (universal, probabilistic). Boolean Circuits. Complexity classes (P, NP, coNP, PSPACE, NL, P/poly, BPP) and their relations. Diagonalization, space complexity, randomized computation. Selection of topics such as interactive proofs, cryptography, quantum computation, hardness of approximation, decision trees, or algebraic computational models.

CS 361: Combinatorial Machine Learning (3-0-3)
Prerequisites: CS 260 Design and Analysis of Algorithms, CS 220 Data Analytics. The course covers tools for design and analysis of decision trees, decision rules and tests, their applications to supervised machine learning, and related topics including current results of research. The main contents are: introduction (basic notions and examples from applications); tools (relationships among decision trees, rules and tests, bounds on complexity of tests, decision rules and trees, algorithms for construction of tests, decision rules and trees); applications (supervised machine learning); some of the additional topics (decision trees, rules and tests, global and local approaches to the study of problems over infinite sets of attributes, applications to combinatorial optimization, fault diagnosis, pattern recognition, analysis of acyclic programs, data mining and knowledge representation); current results of research.

CS 372: Computational Geometry (3-0-3):
Prerequisites: CS 260. This course presents worst-case efficient algorithms for geometric problems. The main topics are: Notions of discrete geometry (convex hulls, planar graphs, triangulations, Delaunay graphs, Voronoi diagrams, arrangements of lines, point-line duality). Geometric algorithms design techniques (plane sweep, randomized incremental construction, bucketing, divide and conquer). Geometric data structures (doubly-connected edge list, history graphs, range trees, segment trees, interval trees) Low-dimensional linear programming. Topological lower bounds. Implementation issues. These theoretical results are presented in connection with applications to computer graphics, robotics, databases, geographic information systems.

CS 380: GPU and GPGPU Programming (3-0-3)
Prerequisites: Good C/C++ programming skills, or other strong programming background. Understanding of basic computer architecture. Recommended optional prerequisites: CS 248, CS 280, CS 292. The course covers the architecture and programming of GPUs (Graphics Processing Units). It covers both the traditional use of GPUs for graphics and visualization, as well as their use for general purpose computations (GPGPU, GPU Computing). The main contents are: GPUM-core hardware architecture, shading and GPU programming languages and APIs, programming vertex, geometry, and fragment shaders, programming with CUDA, Brook, OpenCL, stream computing, approaches to massively parallel computations, memory subsystems and caches, rasterization, texture mapping, linear algebra computations, alternative and future architectures.

CS 390 D: Special Topics: Computational Imaging and Display (3-0-3)
Prerequisites: AMCS 251 This course provides an introduction to computational imaging and display. Starting from image formation models for conventional and unconventional camera designs, we derive inverse problems for image reconstruction in 2D and 3D. Specific applications include standard camera imaging pipelines, light field and high dynamic range cameras, 3D imaging using conventional cameras as well as transient and time-of-flight approaches. Finally we will discuss how to apply the same techniques to the design of computational displays with extended capabilities.

CS 397: Doctoral Dissertation Research (variable credit)
Doctoral-level supervised research.

CS 398: Doctoral Graduate Seminar (variable credit)
Doctoral-level seminar focusing on special topics within the field.

CS 399: Doctoral Directed Research (variable credit)
Doctoral-level supervised research.

6. KAUST University Requirements
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.

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 M.S. degree requires successful completion of 36 credits. Students are expected to complete the M.S. 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://www.kaust.edu.sa/faculty-advisors.html

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.
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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<th>Member</th>
<th>Role</th>
<th>Program Status</th>
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<tr>
<td>1</td>
<td>Chair</td>
<td>Within Program</td>
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<td>2</td>
<td>Faculty</td>
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<td>3</td>
<td>Faculty or Approved Research Scientist</td>
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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 P.h.D core requirements that is passed with a minimum grade of B– may be used towards meeting the core P.h.D requirements of the program if the student chooses to continue for a P.h.D degree in at 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.

Thesis format requirements are described in the KAUST Thesis and Dissertation Guidelines: http://libguides.kaust.edu.sa/theses
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 coursework 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://libguides.kaust.edu.sa/theses

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. P.h.D students typically complete the degree in 5 years.

8.4 Dissertation and Dissertation Defense
The Dissertation Defense is the final exam of the Ph.D. degree. It involves a public presentation of the results of the dissertation research followed by a question and answer session. The Dissertation Defense committee consists of 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</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</td>
<td>Outside Program</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 Emerit 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

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.

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

10. Grading
The KAUST grading system is a 4.0 scale utilizing letter grades, and these are the only grades that will be assigned.
A = 4.00  C = 2.00
A- = 3.67  C- = 1.67
B+ = 3.33  D+ = 1.33
B = 3.00  D = 1.00
B- = 2.67  D- = 0.67
C+ = 2.33  F = 0.00

I = Incomplete
IP = In Progress
W = Withdraw
S = Satisfactory
U = Unsatisfactory
WF = Withdrawn-Failed

### 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 grade (IP)
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 been 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.

### 10.5 Academic standing
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.

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.

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

**Cumulative Assessment**
- **GPA**
  - Good Standing: 3.00 – 4.00
  - Academic Notice: 2.67 – 2.99
  - Academic Probation: 2.33 – 2.66
  - Academic Dismissal: Below 2.33

**S/U Performance**
- **Academic Standing**
  - IP: GPA Standing
  - U: GPA Standing less one (1) category
  - S: GPA Standing less two (2) categories
  - 9+ credits: Academic Dismissal

**Semester Assessment**
Registered in 12 credits
- **Credits Earned**
  - Academic Standing: 12+ credits
  - GPA Standing: 9-11 credits
  - GPA Standing less one (1) category: 6-8 credits
  - GPA Standing less two (2) categories: 0-5 credits

Registered in 9 credits
- **Credits Earned**
  - Academic Standing: 9+ credits
  - GPA Standing: 6 – 8 credits
  - GPA Standing less one (1) category: 3 – 5 credits
  - GPA Standing less two (2) categories: 0 – 2 credits

**Summer Session Assessment**
- **Credits Earned**
  - GPA Standing: 6 credits
  - GPA Standing less one (1) category: 3 – 5 credits
  - GPA Standing less two (2) categories: 0 – 2 credits

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

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 student is responsible for supplying an official transcript:

- The transcript must include the course name, level, grade and credit value.
- The credit value of the course must be equivalent to a minimum of three (3) KAUST credit hours.

Course Transfer and Equivalency
Graduate credit hours taken from any KAUST program may be applied to other KAUST graduate programs under the guidelines of the degree program to which the student is admitted. Graduate courses taken from another university or KAUST program that are equivalent in level and content to the designated courses in a major track may be counted toward the major track requirement if their equivalence is confirmed by the program chair.

Students transferring from other Ph.D. programs may receive some dissertation research and coursework credit units, on a case-by-case basis, for related work performed at their original institution. However, such students must satisfy the written and oral requirements for a research proposal (if the proposal had been submitted and approved at the original institution, the proposal may be the same, if approved by the research advisor). The minimum residency requirement for enrollment of such students at KAUST is two (2) years.

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 late. 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.