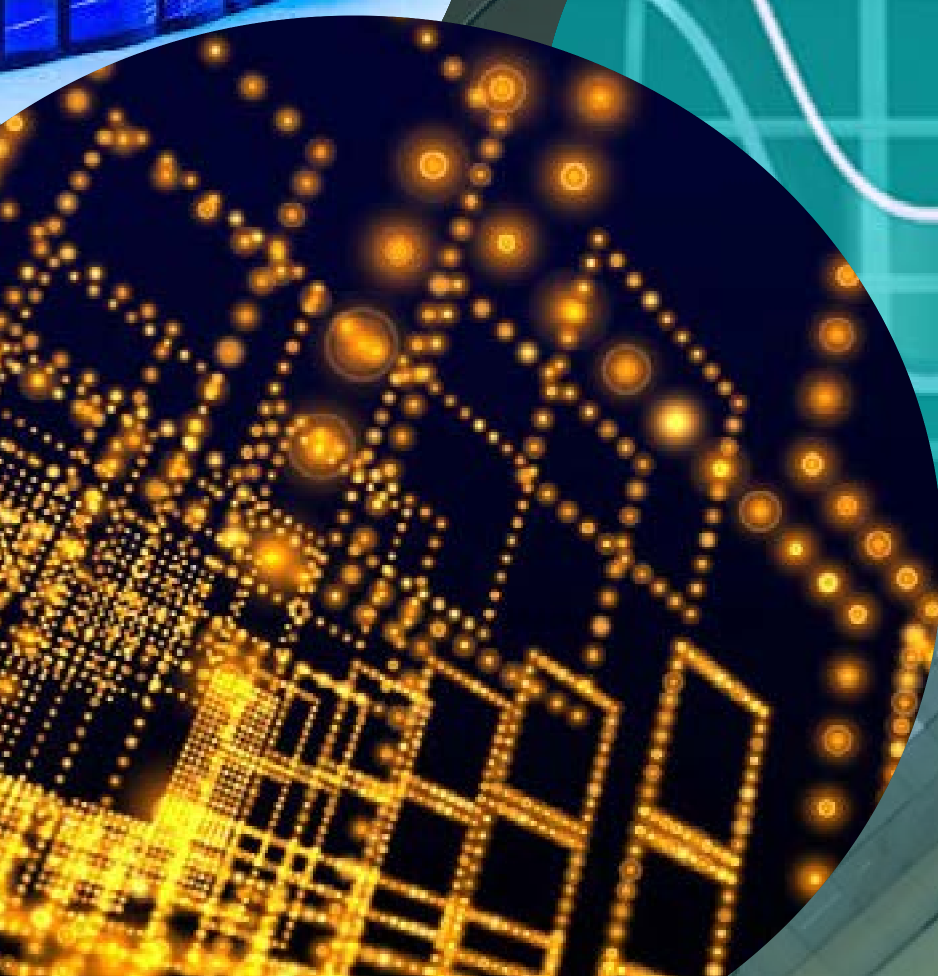
Computer Science



Program Guide

2017-2018

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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 degrees: the Doctor of Philosophy (Ph.D.) degree and the M.S. degree 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 are admitted to KAUST from a wide variety of programs and backgrounds. In order to facilitate the design of an appropriate study plan for each individual student, all admitted students are required to take a written assessment exam when they arrive on Campus. The exam will focus on mathematics and basic sciences. The purpose of the assessment is to determine whether students have mastered the prerequisites for undertaking graduate-level courses taught in the program. The Academic Advisor works with admitted students to develop a study plan if needed. Students are encouraged to prepare for the assessment by refreshing the general knowledge gained from their undergraduate education before arriving at KAUST. The remedial study plan requirements must be satisfactorily completed, in addition to the University degree requirements.

3. Master's Degree Requirements

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.

The Master's Degree (M.S.) is awarded upon successful completion of a minimum of 36 credit hours. A minimum GPA of 3.0 must be achieved to graduate. Individual courses require a minimum of a 'B-' for course credit. Students are expected to complete the M.S. degree in three semesters and one Summer Session.

3.1 M.S. Course Requirements

- Core Courses
- Elective Courses
- Research/Capstone Experience

- Graduate Seminar 298 (non-credit): All students are required to register and receive a satisfactory grade for every semester the program requires they attend.

3.1.1 Core Courses (twelve credits) – choose four courses

Students enrolled toward the M.S. degree are 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.

3.1.2 Elective Courses (twelve credits)

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.

3.1.3 Winter Enrichment Program

Students are required to satisfactorily complete at least one full Winter Enrichment Program (WEP).

3.2 M.S. Thesis Option

Students wishing to pursue the thesis option must apply by the ninth week of their second semester for a thesis 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 fulltime program-affiliated Assistant, Associate or Full Professor at KAUST. This advisor can only become project-affiliated for the specific thesis project upon program level approval. Project-affiliation approval must be completed prior to commencing research.

3.2.1 M.S. Thesis Defense Requirements

An oral defense of the M.S. Thesis is required, although it may be waived by the Dean's Office under exceptional circumstances. A requirement of a public presentation and all other details are left to the discretion of the thesis committee.

A written thesis is required. It is advisable that the student submits a final copy of the thesis to the Thesis Committee Members at least two weeks prior to the defense date.

- Students are required to comply with the university formatting guidelines provided by the library CLICK HERE
- Students are responsible for scheduling the thesis defense date with his/her thesis committee.
- A pass is achieved when the committee agrees with no more than one dissenting vote, otherwise the student fails. The final approval must be submitted at the latest two weeks before the end of the semester.

3.2.2 M.S. Thesis Defense Committee

The M.S. 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:

Member Role Program Status:

Member	Role	Program Status
1	Chair	Within Program
2	Faculty	Within Program
3	Faculty or Approved Research Scientist	Outside Program
4	Additional Faculty	Inside or Outside KAUST

Notes:

- Members 1-3 are required. Member 4 is 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.

View a list of faculty and their affiliations: CLICK HERE

3.3 M.S. Non-Thesis Option

Students wishing to pursue the non-thesis option must complete a minimum of six credits of Directed Research (299). Summer internship credits may be used to fulfill the research requirements 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 or a combination of the options listed below:

- Broadening Experience Courses: Courses that broaden a student's M.S. experience.
- Internship: Research-based Summer Internship (295). Students are only allowed to take one internship.
- PhD Courses : Courses numbered at the 300 level.

It should be noted that a student may also combine courses to satisfy the six credit requirement. For example, a student could take one Ph.D.-level course and one graduate-level course in another program. A student may not enroll in two Summer internships.

4. Doctor of Philosophy

The Doctor of Philosophy (Ph.D.) Degree is designed to prepare students for research careers in academia and industry. It is offered exclusively as a fulltime program.

There is a minimum residency requirement at KAUST of three and a half years for students entering with a B.S. Degree and two and a half 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. Degree includes the following steps:

- Securing 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. Degree with a B.S. Degree or a relevant M.S. Degree. Students holding a B.S. Degree must complete all Program Core/Mandatory Courses and Elective Courses outlined in the M.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 their intentions to graduate with an M.S.

Students entering the Ph.D. Degree with a relevant M.S. Degree must complete the requirements below, though additional courses may be required by the Dissertation Advisor.

Ph.D. Courses

- At least two 300-level courses
- Graduate Seminar 398 (non-credit): All students are required to register and receive a Satisfactory grade for every semester the program requires they attend.
- Winter Enrichment Program: Students are required to satisfactorily complete at least one 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 a full WEP for a second time in the Ph.D. Degree.

Students entering the program with an M.S. Degree from KAUST may transfer unused coursework toward the Ph.D. program requirements subject to program level approval. Students transferring from another university's Ph.D. program may receive some Dissertation Research and Coursework credit 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 Ph.D. Designation of Dissertation Advisor

The selected Dissertation Advisor must be a full time program-affiliated Assistant, Associate or Full Professor at KAUST. The student may also select an advisor from another program at KAUST. This advisor can only become project-affiliated for the specific thesis project with program level approval. Project-affiliation approval must be completed prior to commencing research.
View a list of faculty and their affiliations: CLICK HERE

4.3 Ph.D. Candidacy

In addition to the coursework requirements, the student must successfully complete the required Ph.D. qualification milestones to progress towards Ph.D. candidacy status. These milestones consist of the subject-based qualifying examination and Ph.D. Proposal Defense.

4.3.1 Subject-Based Qualifying Exam

The purpose of the subject-based 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 years of their admission. Students admitted to the program with an M.S. Degree must take this exam within one year. Students who fail the subject-based Qualifying Exam with no retake or fail the retake will be dismissed from the University.

4.3.2 Ph.D. Dissertation Proposal Defense Committee

Formation of a Dissertation Proposal Defense 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 Proposal Dissertation Committee must be approved by the Dean. Once constituted, the composition of the Proposal Committee can only be changed with the approval of both the Dissertation Advisor and the Dean.

View a list of faculty and their affiliations: CLICK HERE

4.3.3 Ph.D. 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 year after passing the qualifying exam. The Dissertation Proposal Defense includes two aspects: a written Research Proposal and an oral Research Proposal Defense. Ph.D. students must request to present the Dissertation Proposal Defense to the Proposal Dissertation Committee at the beginning of the Semester they will defend their proposal.

There are four possible outcomes from this Dissertation Proposal Defense:

- Pass
- Pass with conditions
- Fail with retake
- Fail without retake

A pass is achieved when the committee agrees with no more than one dissenting vote, otherwise the students 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 month after the defense date, unless the committee unanimously agrees to change it.

In the instance of a Fail without Retake, the decision of the committee must be unanimous. The deadline to complete the retake is six months after the defense date, unless the committee unanimously agrees to reduce it. 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.

4.4 Ph.D. Defense

To graduate, a Ph.D. candidate has to form a Ph.D. Dissertation Defense Committee, finalize the Ph.D. dissertation and successfully defend his/her Ph.D. dissertation.

4.4.1 Ph.D. Dissertation Defense Committee

The Ph.D. 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.

Member Role Program Status:

Member	Role	Program Status
1	Chair	Within Program
2	Faculty	Within Program
3	Faculty	Outside Program
4	External Examiner	Outside KAUST
5	Approved Research Scientist	Inside KAUST
6	Additional Faculty	Inside or outside KAUST

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 only requirement with commonality with the Proposal Committee is the Supervisor, although it is expected that other members will carry forward to this committee.

If the student has a co-supervisor, this person can be considered one of the above four members required, provided they come under the categories listed. (i.e. meets the requirements of the position).

It is the responsibility of the student to inform the Dissertation Defense Committee of his/her progress, meet deadlines for submitting Graduation Forms, the defense date, etc. It is expected that the student submits his/her dissertation at least six weeks prior to the defense date in order to receive feedback from the committee members in a timely manner.

4.4.2 Ph.D. Dissertation Defense

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

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 submit the required documents to the Graduate Program Coordinator at the beginning of the semester they intend to defend. It is also expected that the student submits their written dissertation to the committee nine weeks prior to the defense date in order to receive feedback prior to the defense date.

The written dissertation is required to comply with the University Formatting Guidelines which are on the library website: CLICK HERE

There are four possible outcomes from this Dissertation Final Defense:

- Pass
- Pass with conditions
- Fail with retake
- Fail without retake

A pass is achieved when the committee agrees with no more than one dissenting vote, otherwise the student fails. If more than one member casts a negative vote, one retake of the oral defense is permitted if the entire committee agrees. 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 revisions is one month after the defense date, unless the committee unanimously agrees to reduce it. The deadline to complete the retake is one month after the defense date, unless the committee unanimously agrees to reduce it. Students who fail the 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 days after the Defense to the Registrar's Office,

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.

CS189: Directed Study (variable credit up to a maximum of 12 credits)

Provides an individualized course of study that meets specific needs in a particular topic as outlined and directed by the instructor. A student may take this course based on the approval of the instructor and the student's home Division.

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 213: 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 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, kernel methods, 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, authorization, 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, CS380 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.

Basic topics: linear algebra for computer graphics, 2D and 3D transformations, mesh data structures, viewing and camera models, local shading models, texturing, shader programming.

Advanced topics: color, radiometry, real-time rendering, bump mapping, environment mapping, bounding volumes, hierarchical data structures, collision detection, parametric curves, ray tracing, photon mapping, path tracing, anti-aliasing, reaction-diffusion, scanning, normal estimation, ransac, quaternions and displays.

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, hushing); P and NP (Cook's theorem, examples of NP-complete problems); approximate algorithms for NP- hard problems or polynomial algorithms for sub problems 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)

Prerequisites: Advanced and multivariate calculus, and linear algebra, computer graphics and programming experience. Terminology, coordinate systems and implicit forms. Parametric and spline representations of curves and surfaces and their uses. Basic differential geometry of curves and surfaces. Subdivision surfaces. Solid modeling paradigms and operations. Robustness and accuracy in geometric computations. Applications.

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

Prerequisites: programming experience. Architecture of processors, cache hierarchies, memory systems, storage and IO systems, interconnection networks, and message-passing multi-processor systems. History of high performance computing. Processing and communication benchmarks. Parallel programming models. Single-node performance and parallel scaling of real applications. Locality, synchronization, communication and computation overlap, performance/power trade-offs, and reliability.

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

Prerequisites: programming experience and familiarity with basic discrete and numerical algorithms.
Practical aspects of application development for high performance computing. Programming language choice; compilers; compiler usage. Build management using make and other tools. Library development and usage. Portability and the GNU auto-configure system. Correctness and performance debugging, performance analysis. Group development practices and version control. Use of third-party libraries and software licensing.

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 (zero 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 main types of PGMs, i.e., directed PGMs and undirected PGMs. For directed PGMs we will cover Bayesian networks with one of its most important variants, hidden Markov models. For undirected PGMs, we will cover Markov networks (or Markov random fields) with one 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, motivations, ideas, definitions, examples, properties, representations, inference algorithms, and applications for the corresponding PGM will be introduced. This is done through lectures by the instructor. In the next two 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 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 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 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 343: Advanced Distributed and Networked System (3-0-3)

Prerequisites: CS 240

This class is a graduate seminar that covers design and implementation concepts in distributed systems and networked systems by reviewing a selection of classical and contemporary papers. We will study efficient system design and evaluation as well as learn high-level system issues with a focus on exciting topics in distributed and networked systems. Research in these areas also tends to be scattered across disjoint sets of researchers and conferences and the course attempts to study commonalities. The syllabus for this course will vary from year to year so as to cover a mixture of older and more contemporary systems papers. Contemporary papers will be generally selected from the past 5 years, primarily drawn from high quality conferences such as SOSP, SIGCOMM, OSDI, NSDI and EuroSys. On completion of this module, students should have a broad understanding of some key papers and concepts in computer systems research as well as an appreciation of how to argue for or against any particular idea. There is no textbook for this course.

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 345; Advanced Topics in Distributed and Networked Systems (3-0-3)

This course is a graduate seminar that covers design and implementation concepts in distributed systems and networked systems by reviewing a selection of classical and contemporary papers. We will study efficient system design and evaluation as well as learn high-level system issues with a focus on exciting topics in distributed and networked systems. Research in these areas also tends to be scattered across disjoint sets of researchers and conferences and the course attempts to study commonalities.
The syllabus for this course will vary from year to years so as to cover a mixture of older and more contemporary systems papers. Contemporary papers will be generally selected from the past 5 years, primarily drawn from high quality conferences such as SOSP, SIGCOMM, OSDI, NSDI and EuroSys.
On completion of this module students should have a broad understanding of some key papers and concepts in computer systems research, as well as an appreciation of how to argue for or against any particular idea.
There is no textbook for this course.

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 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 tables with many-valued decisions, approximate 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, and 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, and 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, and 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: GPU many-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 390D: 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 390F: Applied Ontology

Prerequisite: CS 213.

The course covers advanced topics in conceptual modelling, data management, integration and analysis, with applications in biology and biomedicine. The aims of the course is to provide an in-depth understanding of the state of the art in formal ontologies, including their role in integrating and analyzing data in biology.

CS 390H: Big Data Optimization

Prerequisite: Linear algebra, multivariate calculus, probability theory and programming. Ability to understand mathematical proofs. Experience with a high level computer language (e.g. Matlab, Julia, Python, and C++)
Mathematically rigorous introduction into the field of big data optimization. Randomized algorithms in numerical linear algebra, convex optimization and machine learning.

CS 390I: Integrating Symbolic and Statistical AI

The course covers advanced topics in Artificial Intelligence. Symbolic approaches to artificial intelligence represent entities within a domain of knowledge through physical symbols, combine symbols into symbol expressions and structures and manipulate symbols and symbol expressions and structures through inference processes. Statistical approaches to AI include many machine learning, data mining and optimization methods in which target functions are approximated. Statistical approaches are useful in learning patterns and regularities, while symbolic approaches are useful in representing knowledge and manipulating symbols to infer new knowledge. The aim of the course is to explore combinations of statistical and symbolic approaches to AI. In particular, the course will focus on interfaces between learning, representation and inference.

CS 397. Doctoral Dissertation Research (variable credit)

Doctoral-level supervised research.

CS 398. Doctoral Graduate Seminar (zero 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

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-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, with a focus on 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 twelve graduate programs leading to M.S. and Ph.D. Degrees.

KAUST offers the following two Degrees:

- The M.S. Degree typically takes three Semesters and a Summer Session to complete (18 months). The Degree allows flexibility for Internships, Research and Academics.
- The Ph.D. Degree is typically a three to four year post-master's Degree. The Ph.D. involves original Research, culminating in a Research Dissertation.

There are three Academic Divisions:

Biological and Environmental Science and Engineering (BESE)

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

Computer, Electrical and Mathematical Science and Engineering (CEMSE)

- Applied Mathematics and Computational Science (AMCS)
- Computer Science (CS)
- Electrical Engineering (EE)

Physical Science and Engineering Division (PSE)

- Chemical and Biological Engineering (CBE)
- Chemical Science (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 or 300 Level.

7. Master's Program

7.1 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.

7.2 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 semesters plus one Summer session. Degree requirements are divided into three sections: Core Curriculum and/or mandatory Courses; 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 on 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 Sessions and Winter Enrichment Program (WEP) is mandatory.
- Summer Session courses are credit bearing and apply towards the degree.
- WEP Courses do not earn credit towards the degree.

At least 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.

View a list of Faculty and their affiliations CLICK HERE

7.2.1 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 twelve credit hours completed at the conclusion of the first Semester and be registered in at least twelve 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 timeframe, not to exceed the end of 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.

Thesis format requirements are described in the KAUST Thesis and Dissertation Guidelines: CLICK HERE

Thesis Defense

The evaluation of M.S. Thesis credits comprises of a Satisfactory (S) or Unsatisfactory (U) Grade. The requirement of a Public Seminar based on the student's work is left to the discretion of the M.S. Thesis Advisor. 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 weeks prior to the defense date.

Thesis Defense Committee

Evaluation of satisfactory completion of M.S. Thesis Work is performed by the M.S. Thesis Defense Committee.

The M.S. Thesis Defense Committee, which must be approved by the student's Dean, must consist of at least three members and typically include 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:

Member Role Program Status:

Member	Role	Program Status
1	Chair	Within Program
2	Faculty	Within Program
3	Faculty or Approved Research Scientist	Outside Program
4	Additional Faculty	Inside or outside KAUST

Notes:

- Members 1-3 are required. Member 4 is 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.

7.2.2 Non-Thesis Option

Students wishing to pursue the non-thesis options must complete a minimum of six credits of Directed Research (299). Summer internship credits may be used to fulfil the research requirements 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 or a combination of the options listed below:

- Broadening Experience Courses: Courses that broaden a student's M.S. experience.

- Ph.D. Courses: Courses numbered at the 300 level.

It should be noted that a student may also combine courses to satisfy the six credit requirement. For example, a student could take one Ph.D.-level course and one graduate-level course in another program. A student may not enroll in two Summer internships. 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-page description of the research and an explanation of how such research would be relevant to the degree program. Upon approval by the Program Chair 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 requirements to those listed above.

View a list of Faculty and their Affiliations: CLICK HERE

8. Ph.D. Program

8.1 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 phases and associated milestones for Ph.D. students:

- Passing a qualifying exam.
- Passing an oral Defense of the Dissertation Proposal.
- Dissertation phase with a final Defense milestone.

8.2 Ph.D. Degree Requirements

There is a minimum residency requirement (enrolment period at KAUST) of two and a half years for students entering with a M.S. Degree, three and a half years for students entering with a B.S. Degree. Qualification and advancement to candidacy are contingent upon: successfully passing Ph.D. coursework, designating a Research Advisor, successfully passing a Qualifying Exam and writing and orally defending a research proposal. Possible outcomes include Pass, Failure with complete Retake, Failure 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 one year after passing of qualifying exam; two years for students entering with a B.S. Degree.

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

The required coursework is outlined below and refer to Paragraph 5 (Program Courses and Descriptions) for specific program course requirements:

M.S. Degree

- Mandatory and/or Core courses (depending on program).
- Elective courses

Ph.D. Degree

- Two or more courses (six credits of coursework) at 300 level
- Graduate Seminar (if required by the Program)

Students entering the program with a relevant M.S. Degree from another institution may transfer coursework towards the requirements of the M.S. Degree upon approval of the Program Chair.

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

Students entering with a B.S. degree from another institution may transfer in up to nine credits of graduate level coursework towards the above requirements upon approval of the Program Chair. In addition, students entering with a B.S. Degree 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. program, there may be additional courses required as specified by the advisor.

8.3 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: **CLICK HERE**

Passing the qualification phase is achieved by acceptance by all the committee members of the written proposal and positive vote of all, but, at most, one member of the Oral Exam Committee. If more than one member casts a negative vote, one 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.

8.4 Dissertation Research Credits

Besides coursework (six 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 fulltime workload for Ph.D. students is considered to be twelve credit hours per semester (courses and 397) and six credit hours in summer (397 only). There is a minimum residency requirement (enrolment period at KAUST) of two and a half years for students entering with an M.S. Degree and three and a half years for students entering with a B.S. Degree. Ph.D. students typically complete the degree in five years.

8.5 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 by the Ph.D. Dissertation Defense Committee. 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 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: CLICK HERE

The result of the defense will be made based on the recommendation of the committee. There are four possible results:

- **Pass:** The student passes the exam and the dissertation is accepted as submitted.
- **Pass with Conditions:** The student passes the exam but the student is advised of the revisions that must be made to the text of the dissertation.
- **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 one month from the date of the first defense.
- **Failure:** The student does not pass the exam and the dissertation is not accepted therefore the degree is not awarded and the student is dismissed from the University.

8.6 Ph.D. Dissertation Defense Committee

The Ph.D. 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 on 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:

Member	Role	Program Status
1	Chair	Within Program
2	Faculty	Within Program
3	Faculty	Outside Program
4	External Examiner	Outside KAUST
5	Approved Research Scientist	Inside KAUST
6	Additional Faculty	Inside or outside KAUST

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 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.
CLICK HERE

9. Program Descriptions

The M.S. and Ph.D. Degree program requirements listed above represent general university-level expectations. The specific details of each degree's requirements are outlined in the descriptions of the individual degree programs.

Course Notation:

Each course is listed prefaced with its unique number and post fixed with (L-C-R) where:

L = the lecture hours to count towards fulfilling the student workload during the semester.
C = the recitation or laboratory hours
R = the credit hours towards fulfilling a degree course requirement.

E.g. CS220 Data Analytics (3-0-3) has a total of three hours of lectures per week, has no labs and earns three credits for the semester.

9.1 University Wide Courses

University Wide Courses are courses in areas not tied to any specific degree program. They are designed to meet institutional requirements, provide broadening experience or to provide supplemental preparation to support students in their degree.

These are listed below:

9.1.1 English as a Second Language

These courses are designed to provide English language training for students who do not fully meet the University's English language entrance requirements. Students will be assigned courses based on their level of English or proficiency.

ESL101 English as a Second Language I (6-0-0)

ESL101 is a foundational English skills course for reading, listening, speaking and writing. The course has a strong focus on teaching students the basics of academic writing and grammar structures in preparation for thesis work. Course materials are typically A2 level to help students acquire basic academic English skills required for graduate coursework.

ESL102 English as a Second Language II (3-0-0)

ESL102 is a pre- English skills course for reading, listening, speaking and writing. The course continues to focus on building academic writing and grammar skills and also have more emphasis on reading for academic purposes. Course materials are typically B1 level to help students further develop pre-intermediate English skills required for graduate coursework.

ESL103 English as a Second Language III (3-0-0)

ESL103 is an upper-intermediate English skills course for reading, listening, speaking and writing. The course helps to further develop academic English skills necessary to successfully complete research and thesis work. Course materials are typically B2 level to help students refine upper-intermediate English skills required for graduate coursework.

9.1.2 Enrichment Program - WEP Courses

The Winter Enrichment Program (WEP) takes place in January each year and is designed to broaden students' horizon. WEP is an essential and core requirement of the degree programs at KAUST. Satisfactory completion of at least one WEP is required of all M.S. students as part of the completion of the degree requirements. Ph.D. students who did not receive their M.S. Degree at KAUST are also require to satisfactorily complete at least one WEP. To satisfy this mandatory requirement, full participation must occur within a single WEP period.

9.2 Innovation and Economic Development

9.2.1 IED Technology Innovation and Entrepreneurship (3-0-3)

This course introduces students to using an entrepreneurial and design thinking view to solving real-world challenges including the pathway to commercializing research. It is about changing methods of thinking and equipping graduate students to be able to understand and manage innovation in the corporate world. This course is open to all M.S. students as an elective and to Ph.D. students with permission of their academic advisors.

9.2.2 IED220 – New Venture and Product Innovation Challenge (6-0-6)

This is an experiential, industry mentor-led program: This course will enable students to 'learn-by-doing' through the development of a fully formed business proposition for real intellectual property that has been developed in the Kingdom. The objective is to create a plan for commercialization and launch of a new products and/or new venture. The process will include students learning how to creatively view technology opportunities; the identification and assessment of opportunity and the structuring and packaging of a validated commercial idea. In addition, students will learn key skills including the development of real-world strategy, planning and teambuilding, integrating continuous feedback and communicating key concepts to different audiences.

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	=	Withdrew			
S	=	Satisfactory			
U	=	Unsatisfactory			
WF	=	Withdrew-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 Failing (F) 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 Incomplete grade while in a degree program at KAUST.

10.2 In-Progress Grades

Thesis Research (297) or Dissertation Research (397) should be graded as In-Progress (IP) or Unsatisfactory

(U) 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	=	Summer Internship	-	Either 'S' or 'U'
298/398	=	Seminar	-	Either 'S' or 'U'
299/399	=	Directed Research	-	Either 'S' or 'U'

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 towards the degree. WEP Courses do not earn credit towards the degree.

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.

11. 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 categories of decreasing levels of Academic Performance:

- Good Standing
- Academic Notice
- Academic Probation
- Academic Dismissal

Cumulative Assessment:

GPA	Academic Standing
3.00-4.00	Good Standing
2.67-2.99	Academic Notice
2.33-2.66	Academic Probation
Below 2.33	Academic Dismissal

S/U Performance	Academic Standing
0-2 Credits	GPA Standing
3-5 Credits	GPA Standing less one category
6-8 Credits	GPA Standing less two 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 category
6-8 Credits	GPA Standing less two categories
0 -4 Credits	Academic Dismissal

Semester Assessment (Registered in 9 Credits)

Credits Earned	Academic Standing
9+ Credits	GPA Standing
6-8 Credits	GPA Standing less one category
3-5 Credits	GPA Standing less two categories
0-2 Credits	Academic Dismissal

Summer Session Assessment

Credits Earned	Academic Standing
6 Credits	GPA Standing
3-5 Credits	GPA Standing less one category
0-2 Credits	GPA Standing less two categories

Definitions:

Good Standing
Student is making satisfactory academic progress towards the degree.

Academic Notice
Student is not making satisfactory progress towards the degree. A student placed on Academic Notice will be monitored in subsequent semesters to ensure satisfactory progress towards 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 towards the degree. A student placed on Academic Probation will be monitored in subsequent semesters to ensure satisfactory progress towards 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 towards 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 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 Unsatisfactory (U) Grades, a Faculty Member giving a 'U' Grade for a course involving six or more credits must obtain concurrency 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 six 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 3.0. A student not in Good Standing due to 'U' Grades may return to Good Standing by completing at least twelve credits during the subsequent semester with no 'U'

grades and a semester GPA of at least 3.0 in traditionally graded courses.

12. 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 graduate-level courses not to exceed nine credits may be transferred for credit. Courses already used for another degree cannot be used as transferred credits.
- 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 years prior to admission to KAUST.
- The student must submit a completed KAUST Transfer of Credit Form and include the Course Syllabus and Course Description
- The student is responsible for supplying an official transcript:
- The transcript may be no more than three months old.
- The transcript must be in English or accompanied by a certified English translation.
- The Grading Key must be included with the 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 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 towards meeting 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 enrolment of such students at KAUST is two years.

13. 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 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 Withdraw (W). 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.

14. 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.