PH.D. PROGRAM IN COMPUTATIONAL SCIENCE

2023-2024 Program Handbook

Joint Program Offered

by

San Diego State University

and

University of California, Irvine

Revised: February 13, 2024

Computational Science Ph.D. Program

Participating Units

- Donald Bren School of Information and Computer Science, UC Irvine
- Samueli School of Engineering, UC Irvine
- College of Engineering, SDSU
- College of Science, SDSU

Program Supervision and Administration

Overall program supervision will be the joint responsibility of a graduate faculty group at UCI and SDSU. A Program Director will be appointed at each campus. The two Program Directors will oversee the operation of the program, advise students, appoint preliminary advisors and recommend appointments to Doctoral Committees. At SDSU, the Office of Graduate and Research Affairs (GRA) processes forms for advancement to candidacy, checks program requirements, and sends notices to students. At UC Irvine, the Graduate Division processes official graduate student forms, reviews student records to ensure that degree requirements have been met, and sends official communications to graduate students enrolled at UC Irvine. Diplomas will be issued jointly.

SDSU Program Director: Dr. Jose Castillo - jcastillo@sdsu.edu

UCI Program Director: Dr. Filippo Capolino - f.capolino@uci.edu

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UCI Staff Contact: Jean Macneil - jean.macneil@uci.edu

Admission Requirements

Students must be admitted to both institutions jointly. However, students must apply to UCI first. Admission will be granted to a ***limited number*** of qualified students, and therefore application should be made as early as possible. Applications are encouraged from both men and women, and particularly from members of underrepresented groups. Completed applications are due by **January 15th** for the Fall term, although later applications may be allowed at the discretion of the Admissions Committee. The Admissions Committee has the sole responsibility of deciding admissions, consistent with both campus regulations. The admissions review process may include personal interviews of applicants.

To be admitted to the Joint Ph.D. Program, an applicant must have received a baccalaureate degree in one of the Science, Technology, Engineering, and Mathematics (STEM) fields, with background in Linear Algebra, Differential Equations, Statistics, and Programming in a language such as C or Fortran. Applicants will be evaluated on the basis of their prior academic record and their potential for creative research and teaching, as demonstrated in submitted application materials. These materials will include official university transcripts, letters of recommendation, GRE scores, Resume and Statement of Purpose from an accredited institution. The applicant must have an undergraduate Grade Point Average of at least 3.0, and of at least 3.50 in any prior graduate course work. The applicant must, in addition, have attained such a scholastic record and present such confidential recommendations as to indicate that he or she is well qualified to pursue, with distinction, advanced study and research.

The GRE General is a requirement for admission. Scores on this exam must be less than five years old. Applicants whose primary language is **not** English are required to demonstrate proficiency in English for admission consideration. A minimum score of 80 on the Test of English as a Foreign Language (TOEFL) is required. Oral communication in English is an important factor for admission into our program so we require, 26 or above in TOEFL iBT spoken component; 8 or above in spoken component of IELTS.

For more information, please visit English Proficiency | Graduate Division | UCI

Please note that all international students, including those with Permanent Resident status, who wish to or will be expected to serve as a Teaching Assistant or Teaching Associate must pass an English proficiency exam approved by UCI. Please visit English Proficiency for Teaching Assistantships | Graduate Division | UCI for more information.

Advising

Upon admission to the program, each student will be assigned two Faculty Mentors, one from SDSU, and one from UCI, as appointed by the Program Directors. Students will attend SDSU their first year, UCI the second year and from the third year on the students will attend the campus where their primary advisor is a faculty member.

In their second year, the student will select a primary Doctoral Advisor (from either UCI or SDSU) and a Co Advisor (not from the same campus where the primary advisor is a faculty member) and two other faculty members affiliated with the program, one from each campus, plus one outside member (a UCI faculty not affiliated with the program) to serve on a five-person Doctoral Committee, The selection of the Doctoral Advisor and the Doctoral Committee **must be approved in writing** by the two Program Directors and be consistent with regulations outlining committee composition at both campuses. The Doctoral Committee will then function as the student's official advising unit. The members of this committee administer the Research Report Exam, monitor research progress, Dissertation proposal, and administer the student's Final Exam (Doctoral Dissertation Defense).

Faculty members affiliated with the Joint Ph.D. in Computational Science shall be listed with the program in the UC Irvine catalogue and the SDSU Graduate Bulletin.

Notes on Committee Composition

Committee for Advancement to Doctoral Candidacy

At advancement to doctoral candidacy, all students must include a fifth UCI faculty member on their committee. This faculty member **must not** be affiliated with the Joint Ph.D. Program in Computational Science, and will serve as the Outside Member. The Outside Member will serve as an unbiased and independent judge of both the quality and fairness of the exam. It is desirable that this individual be familiar with the student's research field. If the Chair, Research/Thesis Advisor, or other member of the committee has a financial interest in an

outside entity that carries a possibility of a conflict of interest potentially harmful to the graduate student, and oversight member must be appointed in addition to the general members of the committee. In cases where a possible conflict of interest exists, the Dean of the Graduate Division at UCI shall select the Oversight Member from a list of three nominees agreed upon by the student, the faculty research advisor, and the program directors. The Oversight Member must be a UCI faculty member.

At advancement to doctoral candidacy, students with a primary faculty advisor from SDSU must identify a co-advisor from UCI to be listed on the Ph.D. Form I – Advancement to Candidacy – Ph.D. Degree form.

Doctoral Committee

The Doctoral Committee must include at least three voting members of the University of California Academic Senate. The Doctoral Committee Chair must be affiliated with the Joint Ph.D. Program in Computational Science. As noted above, if a student's Doctoral Committee Chair is an SDSU faculty member, the student must identify a UCI faculty member as Co-Advisor.

Program of Study

A) Unit requirements: A total minimum of 66 units of course work, independent study, and research (including transfer credit) must be completed. These must be distributed as follows:
   - Minimum 18 units of graduate level coursework at SDSU
   - Minimum 24 units of graduate level coursework at UCI
   - Minimum 24 units of Research, Practicum, Dissertation and Graduate Seminar at either institution.

B) Course requirements:
   - Required: attendance at Summer Research Survey, to become familiar with faculty research programs
   - Required: A faculty advisor.

Detailed Program of Study must include the following:

Residency at SDSU (totaling 18 units):

Core Courses at SDSU (9 units):
- MATH 636: Mathematical Modeling (3) or Math 638: Continuous Dynamical Systems and Chaos (3)
- MATH 693B: Advanced Computational PDE's (3)
- COMP 605: Scientific Computing (3)

Elective Courses at SDSU (9 units):
Students select 9 units from the following list, or appropriate substitutions, with approval of the program director and their research mentor.

- AE 601: Computational Fluid Mechanics (3)
- AE 641: Structural Optimization (3)
- AE 670: Optimal Control (3)

- BIOL 606: Biological Data (3)
- BIOL 668: Advanced Biological Data Analysis (3)
- BIOL 740: Phylogenetic Systematics (3)
- BIOMI 608: Programming Problems in Bioinformatics (3)
- CHEM 711: Chemical Thermodynamics (3)
- CHEM 712: Chemical Kinetics (3)
- CHEM 713: Quantum Chemistry (3)
- CIVE 620: Traffic Flow and Control (3)
- CIVE 697: Traffic Signals Systems Operations and Control (3)
- COMP 526: Computational Methods for Scientists (3)
- COMP 607: Computational Database Fundamentals (3)
- COMP 670: Seminar – Problems in Computational Science (3)
- CS 600: Bioinformatics (3)
- CS 610: Computational Genomics (3)
- CS 653: Data Mining and Knowledge (3)
- CS 666: Advanced Distributed Systems (3)
- CS 696: Programming Problems in Bioinformatics (3)
- EE 645: Antennas and Wave Propagation (3)
- EE 657: Digital Signal Processing (3)
- EE 658: Advanced Digital Signal Processing (3)
- EE 665: Multimedia Wireless Networks (3)
- EE 740: Advanced Topics in Physical Electronics Antenna Design (3)
- MATH 693A: Advanced Computational Optimization (3)
- MB 610A-B: Advanced Topics in Molecular Biology (3)
- ME 610: Finite Element Methods (3)
- PHYS 604: Electricity and Magnetism (3)
- PHYS 606: Statistical Mechanics (3)
- PHYS 608: Classical Mechanics (3)
- PHYS 610: Quantum Mechanics (3)
- STATS 657: Statistical and Machine Learning Methods (3)
- STATS 658: Advanced Data Analytics (3)
- STATS 676: Bayesian Statistics (3)
- STATS 678: Survival Analysis (3)
- STATS 700: Data Analysis (3)
- STATS 701: Monte Carlo Methods (3)
- STATS 702: Data Mining (3)

Residency at UCI (totaling 24 units):

Core Courses at UCI (16 Units):

- COMPSCI 206: Principles of Scientific Computing (4)
- COMPSCI 271: Introduction to Artificial Intelligence (4)
- ENGRCEE 290: Merging Models and Data (4)
- STATS 201: Statistical Methods for Data Analysis I (4)

Elective Courses at UCI (8 units):
Students select 8 units from the following list, or appropriate substitutions, with approval of the program director and their research mentor.

- BME 232: Introduction to Computational Biology (4)
- BME 233: Dynamic Systems in Biology and Medicine (4)
- BME 238: Spectroscopy and Imaging of Biological Systems (4)

- CHEM 230: Classical Mechanics and Electromagnetic Theory (4)
- CHEM 231A: Fundamentals of Quantum Mechanics (4)
- CHEM 231B: Applications of Quantum Mechanics (4)
- CHEM 232A: Thermodynamics and Introduction to Statistical Mechanics (4)
- CHEM 232B: Advanced Topics in Statistical Mechanics (4)
- CHEM 250: Computational Chemistry (4)
- CHEM 250L: Computational Chemistry Laboratory (4)
- COMPSCI 211A: Visual Computing (4)
- COMPSCI 221: Information Retrieval, Filtering, and Classification (4)
- COMPSCI 242: Parallel Computing (4)
- COMPSCI 261: Data Structures (4)
- COMPSCI 263: Analysis of Algorithms (4)
- COMPSCI 264: Quantum Computation and Information (4)
- COMPSCI 265: Graph Algorithms (4)
- COMPSCI 266: Computational Geometry (4)
- COMPSCI 268: Introduction to Optimization (4)
- COMPSCI 273A: Machine Learning (4)
- COMPSCI 274A: Probabilistic Learning: Theory and Algorithms (4)
- COMPSCI 274B: Learning in Geographical Models (4)
- COMPSCI 276: Reasoning in Probabilistic Graphical Models (4)
- COMPSCI 278: Probability Models (4)
- COMPSCI 284A: Artificial Intelligence in Biology and Medicine (4)
- COMPSCI 284C: Computational Systems Biology (4)
- EECS 203A: Digital Image Processing (4)
- EECS 215: Design and Analysis of Algorithms (4)
- EECS 227: Cyber-Physical System Design (4)
- EECS 240: Random Processes (4)
- EECS 242: Information Theory (4)
- EECS 250: Digital Signal Processing I (4)
- EECS 280A: Advanced Engineering Electromagnetics I (4)
- EECS 280B: Advanced Engineering Electromagnetics II (4)
- EECS 282: Monolithic Microwave Integrated Circuit (MMIC) Analysis and Design II (4)
- ENGRCEE 250: Finite Element Method in Structural Engineering (4)
- ENGRCEE 270: Flood Risk and Modeling (4)
- ENGRCEE 273: Watershed Modeling (4)
- ENGRCEE 274: Climate Data Analysis (4)
- ENGRCEE 292: Wavelets in Hydrology, Engineering, and Geoscience (4)
- ENGRMAE 230A: Inviscid Incompressible Fluid Mechanics I (4)
- ENGRMAE 230B: Viscous Incompressible Fluid Mechanics II (4)
- ENGRMAE 270A: Linear Systems I (4)
- STATS 202: Statistical Methods for Data Analysis II (4)
- STATS 230: Statistical Computing Methods (4)

Research units at SDSU:

- COMP 897 Doctoral Research (Variable Units)
- COMP 898 Practicum (Variable Units)
- COMP 899 Dissertation (Variable Units)

Research units at UCI:

- COMPSCI 298 Thesis Supervision (Variable Units)
- COMPSCI 299 Individual Study (Variable Units)
- ENGR 299 Individual Research (Variable Units)

Annual Research Survey

An annual seminar/workshop will feature the participating faculty members presenting their current research and possible projects. Attendance is mandatory for all incoming students.

Research Report Examination

The student is expected to pass the Research Report Exam within 3 years of admittance. This exam cannot be taken until all coursework has been completed at both campuses. This examination shall consist of a term research project supervised by a faculty mentor. The student will be required to prepare a written report of the research work performed and its results and offer an oral presentation before the members of the Doctoral Committee. The student must submit to a peer review journal, a paper based on their research report, before giving an oral presentation to the Doctoral Committee. The student will use the form entitled "Nomination of the Doctoral Committee for the Degree of Doctor of Philosophy" (JDP 2) from San Diego State University to nominate the Research Examination Committee. Should a student fail the research report exam, one retake will be allowed at the discretion of the doctoral committee. After successful completion of the Research Exam, the next step is the Dissertation Proposal.

After successful completion of the Research Report Exam, the student is to complete the "Report of the Research Report Examination for the Degree of Doctoral of Philosophy" form (JDP3) at SDSU. The original form will be kept on file at UCI with a copy being kept on file at SDSU.

Please see the Notes on Committee Composition section for information on requirements for the examination.

Practicum and Doctoral Research

Dissertation research will be carried out at either UCI or SDSU, or at an industry or national laboratory under the supervision of the Doctoral Advisor. While conducting dissertation research, students must enroll in the appropriate research units at the campus of the Doctoral Advisor. If research is done outside of UCI or SDSU, students should register in-absentia if appropriate.

Dissertation Proposal/Advancement to Candidacy

Students must submit a Dissertation Proposal to the Doctoral Committee **by the end of their third year in the program**. This proposal should take the form of a scientific grant proposal to a major funding agency. It should describe the research project that the student intends to carry out and upon which their Doctoral Dissertation will be based. The student must also offer an oral presentation of the Proposal before the Computational Science faculty.

After successful completion of the Dissertation Proposal, the student will be recommended for Advancement to Candidacy at both campuses. In order to formally advance to candidacy for the Ph.D., the student is to complete the "Report of the Dissertation Proposal/Advancement to Candidacy for the Degree of Doctoral of Philosophy" form (JDP4) at SDSU and the "Ph.D. Form I – Advancement to Candidacy – Ph.D. Degree" form with appropriate signatures at UCI. The original form will be kept on file at UCI with a copy being kept on file at SDSU. Advancement to Candidacy for the Ph.D. degree must occur at least one term prior to dissertation defense. UCI forms can be found at Forms & Applications | Graduate Division | UCI

Dissertation and Final Oral Examination

On completion of the research, the student will prepare the Dissertation in accordance with UCI regulations, outlined at Degree Completion | Graduate Division | UCI A final draft of the Dissertation will be presented to each member of the Doctoral Committee at least three weeks prior to the final oral examination. For information on UCI's filing deadlines, please visit Filing Deadlines | Graduate Division | UCI The oral defense will be held on the campus of the primary faculty advisor.

Following the completion of the Final Examination, the student must file the "Report of the Final Examination and Filing of the Dissertation for the Degree of Doctor of Philosophy" (JDP 5) at SDSU and the "Ph.D. Form II – Signature Page/Report on Final Examination for the Ph.D." with appropriate signatures at UCI. UCI forms can be found at Forms & Applications | Graduate Division | UCI Originals of these forms will be kept on file at UCI with copies kept on file at SDSU.

Please see the Notes on Committee Composition section for information on requirements for doctoral committees.

Normative Time and Enrollment Requirements

Normative time to degree for the Ph.D. is five years. Maximum time to degree for the Ph.D. is seven years. During this time, a minimum of 66 units of combined coursework, independent study, and research, must be completed.

Throughout their entire program of study, students must be registered at either UCI or SDSU. Students who have completed coursework requirements must enroll in the appropriate research units at the home campus of their primary faculty advisor. International students should consult with International Centers at both SDSU and UCI to ensure that appropriate paperwork is on file with both offices. Full-time registration is required to maintain immigration status.

Requests for leaves of absence or in-absentia registration must be reviewed and approved by both campuses. An approved leave of absence cannot be longer than one year, three quarters, or two semesters.

Health Insurance

Doctoral students enrolled at UCI are required to have health insurance. While enrolled at UCI, students visit Graduate Student Health Insurance Plan (GSHIP) | UCI Student Health Center

At SDSU, International students are required to purchase health insurance through JCB Insurance Solutions or provide documentation of comparable coverage. For more information, please visit F-1 Health Insurance | SDSU

SDSU will provide Domestic doctoral students enrolled at SDSU with health coverage via reimbursement of an approved plan. Students enrolled at SDSU are not eligible for UCI GSHIP.

Library Access

Students enrolled at UCI will have access to UCI Library resources. If students need access to UCI Library resources while enrolled at SDSU, they may purchase a discounted library card for 6 or 12 months. For more information, please visit Get a Library Card | UC Irvine Libraries

Housing

UCI provides a guaranteed offer of on-campus housing for Ph.D. students for normative time to degree minus one year. For this program, the housing guarantee will begin in year 2, and will only continue for years 3 and 4 for those students who secure a UCI faculty advisor. Students will be required to maintain continuous enrollment at UCI and remain in good academic standing to remain eligible for the UCI housing guarantee. Only those students who submit a housing application with UCI prior to the May 1 deadline will receive a guaranteed offer of on-campus housing. For additional information, please visit Housing Guarantees (uci.edu)

SDSU does not provide guaranteed on-campus housing for graduate students. However, a limited number of units may be available. For more information, please visit Home | SDSU

Satisfactory Academic Progress

Graduate students must meet all of the following criteria to maintain satisfactory progress:

- Maintain at least a 3.0 cumulative GPA.
- Advance to candidacy and complete the degree within limitations established by UCI's Graduate Council.
- Receive grades of B or better.
- Enroll in at least 12 graduate or upper-division units of credit each quarter at UCI, or at least 9 units of graduate courses per semester at SDSU, including credit for supervised teaching and research, unless part-time status or an academic leave of absence has been approved in advance. In cases of approved part-time status, enrollment in eight 8 or fewer units of credit toward the degree is expected each quarter.
- Satisfactory progress towards the degree as determined by the student's faculty advisor, committee, or academic unit.

Note: The professional judgment of the faculty, upon review of all graduate work undertaken by the student, is paramount, and the faculty of a particular academic unit may establish more restrictive criteria for satisfactory academic progress. Graduate students must maintain satisfactory academic progress to be eligible for any academic appointment/employment, fellowship support, or other awards.

Policies and Procedures

Students will be subject to the UCI Graduate Policies and Procedures outlined at
Academic Policies | Graduate Division | UCI

Students admitted provisionally must provide the materials needed to complete their files before the end of their first term of enrollment.

Standards of Scholarship and Conduct

Students in the Joint Ph.D. Program in Computational Science will be expected to abide by the high standards of scholarship, research, and professional and collegial conduct outlined in San Diego State and UC Irvine policies, including but not limited to the following:

SDSU Honor Code

1. I will respect the intellectual property of others, giving credit for ideas or information where credit is due. When appropriate, I will compensate others for the use of their ideas or intellectual property.

2. I will respect copyright laws and software licenses; particularly, when completing course assignments or department requirements.

3. While I am encouraged to work with other students currently in our program, I am expected to turn in my own work. I am not allowed to consult with students who have taken previous offerings of the courses I am taking for assistance with homework assignments. I need to consult with both instructors if I want to use part of a project for more than one course. The submission of work originating from previous terms is considered to be a serious honor code violation.

4. In preparing assignments and responses to examinations, I will follow the policies provided by the program and its professors. When I do not understand the policies governing an assignment or exam, I will seek clarification.

5. Unless there are clear policies to the contrary, I will not seek information about the content of course exams, will not disclose such information to others, and will not seek or provide assistance to others in the completion of exams or questions.

6. When communicating with department personnel about my status as a student, my program of study, or my coursework, I will honestly represent my understanding of relevant circumstances, for example, whether I have (or have not) completed course prerequisites or filed specific paperwork.

7. I will stay informed of SDSU and UCI policies regarding plagiarism, cheating, and software use. In particular, I will read and abide by SDSU's Statement of Student Rights and Responsibilities (Student Conduct | SDSU).

(Adapted from SDSU's EDTEC Honor Code)

UCI Academic Senate Policy on Academic Integrity

The University of California, Irvine is an institution of learning, research, and scholarship that is strengthened by the existence of an environment of integrity. As members of the academic community, instructors, students, and administrators are responsible for maintaining this environment. It is essential that all members of the University practice academic integrity and accept individual responsibility for their work and actions. Violating the Academic Integrity Policy is unacceptable, devaluing the teaching and learning experience for the entire community. While at UCI, members of the academic community should become better educated about the ethical framework underpinning academic integrity and improve their moral standards supporting it. The UCI Academic Senate Policy on Academic Integrity states the general rules and procedures associated with student academic integrity. This Academic Integrity Policy applies to undergraduate and graduate students enrolled in a UCI course. A separate policy governs the integrity of research.

All students are expected to complete a course in compliance with the Instructor's standards. No student shall engage in any activity involving any Academic Integrity Policy Violations. No student shall engage in any activity that involves attempting to receive a grade by means other than honest effort, and shall not aid another student who is attempting to do so. All students are encouraged to notify instructors, but may also notify the Academic Integrity Administrative Office, about observed incidents of Academic Integrity

Policy Violations. Instructors should take reasonable steps to preserve the confidentiality of students making such reports. All students have the responsibility to become familiar with and abide by the Academic Integrity Policy.

To read UCI's full Academic Senate Policy on Academic Integrity, please visit The Manuel of The Irvine Division of The Academic Senate

UCI Code of Conduct

Students are expected to behave professionally, with integrity, and with respect for others. The full UCI Code of Conduct is available at UCI Office of Academic Integrity & Student Conduct