

COMPUTER SCIENCE AND ENGINEERING

Graduate Program Head	Chita Das
Program Code	CSE
Campus(es)	University Park (Ph.D., M.S., M.Eng.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Master of Engineering (M.Eng.) Dual-Title Ph.D., M.S., and M.Eng. in Computer Science and Engineering and Operations Research

The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=CSE)
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The department offers courses and is prepared to direct research in a variety of subfields of computer science and engineering, including VLSI, computer architecture, parallel/distributed processors and processing, multiprocessors, interconnection networks, pattern recognition and image processing, performance evaluation, reliability, fault tolerance, theory of computation, computer systems, numerical analysis and optimization, programming methodology, and analysis of algorithms. Research and instruction are supported by extensive computing facilities within the University's Information Technology Services and by the computer laboratories operated by the department.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

All applicants must provide a statement of purpose, resume/CV, 3 letters of recommendation as well as official copies of transcripts, degree/study certificates and/or diplomas, as appropriate. The Graduate Record Examinations (GRE) Aptitude Test (verbal, quantitative, and analytical) is required for all M.S. and M.Eng. applications. GRE scores are no longer required for doctoral applicants. Please review the CSE Graduate Admissions (<https://www.eecs.psu.edu/students/graduate/EECS-How-to-apply-CSE.aspx>) website for additional details.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

For score reporting for TOEFL, the institution code is 2660.

International students seeking a Teaching Assistantship in Computer Science and Engineering will be required pass their AEOOPT (<https://aplng.la.psu.edu/programs/about-the-aeoopt/>) exam before being appointed as a Teaching Assistant.

Degree Requirements

Master of Engineering (M.Eng.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A minimum of 30 credits at the 400, 500, or 800 level is required, with a minimum of 18 credits at the 500 or 800 level, and at least 6 credits at the 500 level.

Code	Title	Credits
Fall Semester		
CMPSC 465	Data Structures and Algorithms	3
6 credits of the following:		6
CMPSC 443	Introduction to Computer and Network Security & CMPSC 431Wand Database Management Systems	
CMPEN 431	Introduction to Computer Architecture & CMPEN 472 and Microprocessors and Embedded Systems	
3 credits of the following:		3
CSE 500 - CSE 589		
CSE 597	Special Topics	
Spring Semester		
12 credits of the following:		12
CSE 500 - CSE 589		
CSE 597	Special Topics	
Summer Semester		
CSE 820	Software & Hardware Project Management	3
CSE 594	Research Topics	3
Total Credits		30

The culminating experience for the program is a master's paper completed while the student is enrolled in CSE 594.

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 31 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. Students may choose to complete a thesis or a scholarly paper. Students choosing to complete a thesis must complete at least 6 credits in thesis research (600 or 610). Students choosing to complete a scholarly paper must complete at least 18 credits in 500-level courses.

Code	Title	Credits
Required Courses		
15-18 credits of CSE courses with at least 15 credits of 500-level courses including any taken from the 9 credit breadth areas (thesis option); at least 18 credits of 500-level courses including any taken from the 9 credit breadth areas (non-thesis option); at most 9 credits of 400-level courses including any taken from the list below.		15-18
9 credits with one course each in the following three breadth areas: algorithms (CMPSC 465 or CSE 565), operating systems (CMPSC 473 or CSE 511), and computer architecture (CMPEN 431 or CSE 530).		9
CMPSC 465	Data Structures and Algorithms	
or CSE 565	Algorithm Design and Analysis	

CMPSC 473 or CSE 511	Operating Systems Design & Construction Operating Systems Design	
CMPEN 431 or CSE 530	Introduction to Computer Architecture Fundamentals of Computer Architecture	
CSE 590	Colloquium	1
Culminating Experience		
CSE 600 or CSE 610	Thesis Research (Thesis) Thesis Research Off-Campus	6
CSE 594	Research Topics (Scholarly Paper)	3
Total Credits		31

Students who choose to complete a thesis must pass a thesis defense. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School. If the student completes a scholarly paper, the paper must be accepted by the supervising faculty member(s) and the head of the graduate program. The scholarly paper is completed while the student is enrolled in CSE 594.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

Students applying for and gaining admittance to the Ph.D. program will not be permitted to switch to the master's program at a later date, except under extenuating circumstances, at the discretion of the program.

To qualify for a Ph.D. degree, students who do not have an M.S. degree in Computer Science or Computer Engineering must take a minimum of 33 credits, including:

Code	Title	Credits
Required Courses		
6 credits of the following:		6
CSE 565	Algorithm Design and Analysis	
CSE 511	Operating Systems Design	
CSE 530	Fundamentals of Computer Architecture	
15 credits of CSE courses (excluding CSE 596 and CSE 598)		15
9 credits of 400-, 500-, or 800-level courses in CSE/EE/MATH/STAT, or 500- or 800-level IST courses (which may include up to 3 credits of CSE 596)		9
CSE 590	Colloquium	2
CSE 591	Research Experience in Computer Science and Engineering	1
Total Credits		33

Students admitted to the Ph.D. program with an M.S. degree in Computer Science or Computer Engineering must take a minimum of 21 credits, including:

Code	Title	Credits
Required Courses		
6 credits of the following:		6
CSE 565	Algorithm Design and Analysis	
CSE 511	Operating Systems Design	
CSE 530	Fundamentals of Computer Architecture	
9 credits of CSE courses (excluding CSE 596 and CSE 598)		9

3 credits of 400-, 500-, or 800-level courses in CSE/EE/MATH/STAT, or 500- or 800-level IST courses (which may include up to 3 credits of CSE 596)

CSE 590	Colloquium	2
CSE 591	Research Experience in Computer Science and Engineering	1
Total Credits		21

A student must pass the Ph.D. qualifying examination by the third regular semester after entering the program. After completion of most of the course work and meeting the English competency requirement, students must pass the Ph.D. comprehensive examination.

A dissertation must be completed under the direction of the Ph.D. committee and the results must be successfully defended in the final oral examination. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Dual-Titles

Dual-Title M.Eng., M.S., and Ph.D. in Computer Science and Engineering and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Admissions Requirements

Students must apply and be admitted to the graduate program in Computer Science and Engineering and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Operations Research dual-title program. Refer to the Admission Requirements section of the Operations Research Bulletin page. (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>) Doctoral students must be admitted into the dual-title degree program in Operations Research prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Computer Science and Engineering, listed on the Degree Requirements tab. In addition, students must complete the degree requirements for the dual-title in Operations Research, listed on the Operations Research Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>).

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Computer Science and Engineering and must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Computer Science and Engineering and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/>

gcac/gcac-600/phd-dissertation-committee-formation/), the Ph.D. committee of a Computer Science and Engineering and Operations Research dual-title Ph.D. student must include at least one member of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Operations Research, the member of the committee representing Operations Research must be appointed as co-chair. The Operations Research representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Computer Science and Engineering and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Computer Science and Engineering (CSE) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/cse/>)

Learning Outcomes

Master of Engineering (M.Eng.)

1. Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Computer Science and Engineering at a depth consistent with their course of study.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering to formulate and solve engineering problems.
3. Graduates will be able to analyze and synthesize knowledge within the field of Computer Science and Engineering to address a complex problem of practical relevance.
4. Graduates will be able to demonstrate proficiency in written communication appropriate to their discipline.
5. Graduates will be able to demonstrate an understanding of and a commitment to, academic integrity and the standards for professional practice within Computer Science and Engineering.

Master of Science (M.S.)

1. Graduates will be able to demonstrate understanding of advanced core principles and methods from selected sub-fields of Computer Science and Engineering at a depth consistent with their course of study.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering to formulate and solve engineering problems.
3. Graduates will be able to analyze and synthesize knowledge within the field of Computer Science and Engineering to extend existing knowledge through a research experience or a course-based culminating experience.
4. Graduates will be able to demonstrate proficiency in oral and written communication appropriate to their discipline.
5. Graduates will be able to demonstrate an understanding of, and a commitment to, the standards of scholarship and research integrity within Computer Science and Engineering.

Doctor of Philosophy (Ph.D.)

1. Graduates will be able to demonstrate an understanding of advanced core principles and methods as well as modern research findings from selected sub-fields of Computer Science and Engineering (CSE) at a depth appropriate for a Ph.D. candidate.
2. Graduates will be able to apply their knowledge of selected sub-fields of Computer Science and Engineering in formulating and executing a research plan.
3. Graduates will be able to demonstrate the ability to analyze and synthesize appropriate literature to critically review their work in the context of the literature, and to formulate and defend conclusions based on their research that represent new scholarly contributions.
4. Graduates will be able to demonstrate high levels of proficiency in oral and written communication.
5. Graduates will be able to demonstrate an understanding of and a commitment to, the standards for scholarship and research integrity.

Contact

Campus	University Park
Graduate Program Head	Chitaranjan Das
Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)	John Morgan Sampson
Program Contact	Erin Ammerman Graduate Admissions W209 Westgate Building University Park PA 16802 exa7@psu.edu (814) 863-1242
Program Website	View (http://www.cse.psu.edu/prospective/graduate/)