COMPUTER ENGINEERING
PHD

Degree Requirements
The following requirements are in addition to, or further elaborate upon, those requirements outlined in The Graduate School Policy Guide (https://catalogs.northwestern.edu/tgs/academic-policies-procedures).

Course Requirements
• Total Units Required: 15 units that count for graduate (TGS) credit.
  • The cumulative grade point average over these 15 units must be a B (3.0 GPA) or higher.
  • Complete the zero-credit GEN_ENG 519-0 Responsible Conduct for Research Training during their first year.
  • In each quarter, the study plan should be approved by the student’s adviser prior to registration.
  • Restrictions:
    • COMP_ENG 590-0 Research does not count toward the 15 units requirement.
    • At most 2 units of COMP_ENG 499-0 Projects can be counted toward the 15 units requirement.
    • At least 6 of the required 15 units should be from 400- or 500-level courses.
    • All “Core Courses” below are mandatory and count toward the 15 units requirement.
    • At least 6 of the required 15 units should be from the "Track Courses" category below.

Core Courses (1 unit)
Course  Title
COMP_ENG 361-0 Computer Architecture I

Track Courses (6 units)
• These courses must fulfill at least three of the six tracks.
  • A track is fulfilled when the student completes at least two of the track's courses. The Computer Architecture track requires only one additional course to be completed (the CE Core Course counts toward completing the Computer Architecture track).
  • A course that is listed in two different tracks can fulfill both track requirements, but can be counted only once toward the 6 units.
  • Additional 300- and 400-level and above courses can fulfill track requirements with the consent of the adviser and the Director of Graduate Studies in Computer Engineering.

Course  Title
Track A. Digital Design & VLSI
COMP_ENG 303-0 Advanced Digital Design
COMP_ENG 355-0 ASIC and FPGA Design
COMP_ENG 357-0 Design Automation in VLSI
COMP_ENG 391-0 CMOS VLSI Circuit Design
COMP_ENG 393-0 Advanced Low Power VLSI and Mixed-signal IC Design
COMP_ENG 459-0 VLSI Algorithmics
COMP_ENG 493-0 Advanced Low Power VLSI and Mixed-signal IC Design

Track B. Embedded Systems
COMP_ENG 346-0 Microprocessor System Design
COMP_ENG 364-0 CyberPhysical Systems Design and Application
COMP_ENG 365-0 Internet-of-things Sensors, Systems, And Applications
COMP_ENG 366-0 Embedded Systems
COMP_ENG 464-0 Cyber-Physical Systems Design and Application
COMP_ENG 465-0 Internet-of-things Sensors, Systems, And Applications
COMP_ENG 466-0 Embedded Systems
ELEC_ENG 390-0 Introduction to Robotics

Track C. Computer Architecture
The Computer Architecture track requires only one course from the list below to be completed.
COMP_ENG 368-0 Programming Massively Parallel Processors with CUDA
COMP_ENG 452-0 Adv Computer Architecture
COMP_ENG 453-0 Parallel Architectures
COMP_ENG 468-0 Programming Massively Parallel Processors with CUDA

Track D. Software Systems
COMP_SCI 321-0 Programming Languages
COMP_SCI 322-0 Compiler Construction
COMP_SCI 323-0 Code Analysis and Transformation
COMP_SCI 339-0 Introduction to Database Systems
COMP_SCI 340-0 Introduction to Networking
COMP_SCI 343-0 Operating Systems
COMP_SCI 351-1 Introduction to Computer Graphics
COMP_SCI 354-0 Network Penetration & Security
COMP_SCI 446-0 Kernel and Other Low-level Software Development
COMP_SCI 455-0 Distributed Computing Systems

Track E. Parallel and Distributed Systems
COMP_ENG 329-0 The Art of Multicore Concurrent Programming
COMP_ENG 358-0 Introduction to Parallel Computing
COMP_ENG 368-0 Programming Massively Parallel Processors with CUDA
COMP_ENG 395-0 Special Topics in Computer Engineering (Blockchain and Cryptocurrency)
COMP_ENG 453-0 Parallel Architectures
COMP_ENG 468-0 Programming Massively Parallel Processors with CUDA
COMP_ENG 495-0 Special Topics in Computer Engineering (Blockchain and Cryptocurrency)
COMP_SCI 340-0 Introduction to Networking
COMP_SCI 455-0 Distributed Computing Systems
ELEC_ENG 333-0 Introduction to Communication Networks

Track F. Algorithms
COMP_ENG 356-0 Introduction to Formal Specification & Verification
COMP_ENG 459-0 VLSI Algorithmics
COMP_ENG 510-0 Seminar (Social Media Mining)
COMP_SCI 336-0 Design & Analysis of Algorithms
ELEC_ENG 332-0 Introduction to Computer Vision
ELEC_ENG 390-0   Introduction to Robotics
IEMS 450-1   Mathematical Optimization I
IEMS 450-2   Mathematical Optimization II
IEMS 457-0   Integer Programming

Other PhD Degree Requirements

• Teaching Requirement
• Admission to PhD Candidacy through coursework or oral qualifier examination
• Prospectus Examination
• Dissertation and Defense

Additional requirements and processes are detailed in the Computer Engineering Graduate Study Guide (https://www.mccormick.northwestern.edu/electrical-computer/graduate/phd/requirements.html) and The Graduate School Policy Guide (https://catalogs.northwestern.edu/tgs/academic-policies-procedures).