

COMPUTER INTEGRATED SURGERY, MINOR

<https://lcsr.jhu.edu/computer-integrated-surgery-minor/>

The Laboratory for Computational Sensing and Robotics in the Whiting School of Engineering offers a minor in Computer Integrated Surgery (CIS) for full-time, undergraduate students at Johns Hopkins. The minor is particularly well suited for students interested in computer integrated surgery issues who are majoring in a variety of disciplines including biomedical engineering, computer science, computer engineering, electrical engineering, and mechanical engineering. The minor provides formal recognition of the depth and strength of a student's knowledge of the concepts fundamental to CIS beyond the minimal requirements of their major.

To add the minor, please follow the instructions below:

1. Students who decide to pursue the minor should first fill out the CIS Advising Plan (<https://lcsr.jhu.edu/computer-integrated-surgery-minor/>), outlining how you plan to complete the minor, and email the completed Information and Checklist to the Robotics Academic Program Manager (<https://lcsr.jhu.edu/admin-staff/>).
2. Once the Checklist sheet is approved, students can complete the "Request a New Major/Minor" form, which can be initiated in SIS Self-Service under the Online Forms screen. Students will be assigned a minor advisor during this process.
3. Complete the Checklist while progressing towards the minor. Students should bring a copy of the Checklist for review when meeting with their minor advisor.
4. During senior year, students should ensure that the Computer Integrated Surgery minor is noted on their graduation application.
5. When all requirements have been completed, submit the completed Checklist to the Robotics Academic Program Manager for review. Questions related to the minor should be directed to the Robotics Academic Program Manager (<https://lcsr.jhu.edu/admin-staff/>).

For the most up-to-date information about the minor, please visit the website (<https://lcsr.jhu.edu/computer-integrated-surgery-minor/>).

The information below describes the academic requirements for students entering JHU as degree-seeking students in Fall 2024. Students who entered JHU as degree-seeking students prior to Fall 2024 should view the appropriate archived catalogue (<https://e-catalogue.jhu.edu/archive/>).

MINOR REQUIREMENTS

The minor in Computer Integrated Surgery (CIS) requires 12 courses and 42 to 45 credits. A grade of C- or higher is required for all courses. No Satisfactory/Unsatisfactory (S/U) grade is accepted. Details of these requirements are as follows:

Fundamental Mathematics Courses

Code	Title	Credits
AS.110.108	Calculus I (Physical Sciences & Engineering)	4
or AS.110.106	Calculus I (Biology and Social Sciences)	
AS.110.109	Calculus II (For Physical Sciences and Engineering)	4
or AS.110.107	Calculus II (For Biological and Social Science)	
AS.110.202	Calculus III	4

or AS.110.211	Honors Multivariable Calculus	
EN.553.291	Linear Algebra and Differential Equations	4
or AS.110.201	Linear Algebra	
or AS.110.212	Honors Linear Algebra	
Total Credits		16

Fundamental Computer Science Courses

Code	Title	Credits
EN.500.112	Gateway Computing: JAVA ¹	3
or EN.500.113	Gateway Computing: Python	
or EN.500.114	Gateway Computing: Matlab	
EN.601.226	Data Structures	4
Total Credits		7

¹ One of the Gateway Computing courses or equivalent experience determined by your CIS minor advisor.

Fundamental CIS Courses

Code	Title	Credits
EN.601.455	Computer Integrated Surgery I	4
EN.601.456	Computer Integrated Surgery II ¹	3
or EN.601.496	Computer Integrated Surgery II - Teams	
Total Credits		7

¹ EN.601.456 or a design course in CIS approved by the CIS minor advisor.

Upper-Level CIS Electives

Code	Title	Credits
One course from either Imaging or Robotics (see below for the course 3-4 listings)		
Three courses from Imaging, Robotics, or Other (See below for the course listings)		9-12
Total Credits		12-15

UPPER-LEVEL CIS ELECTIVE COURSES

Imaging

Code	Title	Credits
EN.520.414	Image Processing & Analysis	3
EN.520.432	Medical Imaging Systems	3
EN.520.433	Medical Image Analysis	3
EN.601.461	Computer Vision	3
EN.601.783	Vision as Bayesian Inference	3

Robotics

Code	Title	Credits
EN.530.420	Robot Sensors/Actuators	4
EN.530.421	Mechatronics	3
EN.530.603	Applied Optimal Control	3
EN.530.646	Robot Devices, Kinematics, Dynamics, and Control	4
EN.601.463	Algorithms for Sensor-Based Robotics	3

Other

Code	Title	Credits
EN.520.448	Electronics Design Lab	3
EN.530.445	Introduction to Biomechanics	3
EN.580.471	Principles of Design of BME Instrumentation	4
EN.601.454	Introduction to Augmented Reality	3
EN.601.476	Machine Learning: Data to Models	3
EN.601.482	Machine Learning: Deep Learning	4