

# 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.

## Declaring the Minor

Students interested in the minor should visit the Laboratory for Computational Sensing and Robotics (<https://lcsr.jhu.edu/computer-integrated-surgery-minor/>) website for instructions on how to declare the minor.

*The information below describes the academic requirements for students entering JHU as degree-seeking students in Fall 2025. Students who entered JHU as degree-seeking students prior to Fall 2025 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. Grades of C- or higher are required for all courses. No Satisfactory/Unsatisfactory (S/U) grade is accepted.

### FUNDAMENTAL MATHEMATICS COURSES

Code	Title	Credits
AS.110.108 or AS.110.106	Calculus I (Physical Sciences & Engineering) Calculus I (Biology and Social Sciences)	4
AS.110.109 or AS.110.107	Calculus II (For Physical Sciences and Engineering) Calculus II (For Biological and Social Science)	4
AS.110.202 or AS.110.211	Calculus III Honors Multivariable Calculus	4
EN.553.291 or AS.110.201 or AS.110.212 or EN.553.295	Linear Algebra and Differential Equations Linear Algebra Honors Linear Algebra Linear Algebra for Data Science	4
<b>Total Credits</b>		<b>16</b>

### FUNDAMENTAL COMPUTER SCIENCE COURSES

Code	Title	Credits
EN.500.112 or EN.500.113	Gateway Computing: JAVA <sup>1</sup> Gateway Computing: Python	3
EN.601.226	Data Structures	4
<b>Total Credits</b>		<b>7</b>

<sup>1</sup> 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 or EN.601.496	Computer Integrated Surgery II <sup>1</sup> Computer Integrated Surgery II - Teams	3
<b>Total Credits</b>		<b>7</b>

<sup>1</sup> 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
<b>Total Credits</b>		<b>12-15</b>

### 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.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.601.482	Machine Learning: Deep Learning	4