B.A. IN COMPUTER SCIENCE

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major in Computer Science (B.A.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COS 100</td>
<td>Introduction to Programming</td>
<td>3</td>
</tr>
<tr>
<td>or COS 205</td>
<td>Scientific Computing</td>
<td></td>
</tr>
<tr>
<td>COS 105</td>
<td>Computer Science 1</td>
<td>4</td>
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<tr>
<td>COS 212</td>
<td>Computer Science 2</td>
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<tr>
<td>COS 214</td>
<td>Computer Architecture</td>
<td>4</td>
</tr>
<tr>
<td>COS 216</td>
<td>Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>COS 301</td>
<td>Operating Systems</td>
<td>4</td>
</tr>
<tr>
<td>COS 450</td>
<td>Humans and Computers</td>
<td>3</td>
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<tr>
<td>MAT 124M</td>
<td>Calculus 1</td>
<td>4</td>
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<tr>
<td>MAT 241</td>
<td>Discrete Mathematics</td>
<td>3</td>
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</table>

Choose two of the following Applications of Computer Science courses:

- COS 313 Database Systems
- COS 318 Web Programming
- COS 334 Data Mining and Machine Learning
- COS 386 Data Communications and Computer Networks
- COS 420 Software Process
- COS 477 Software Engineering

Choose two of the following Applications of Computer Science courses:

- 6 Credits

Electives from 300-level or above
- 9-10 Credits

Computer Science courses or MAT 344 or MAT 376 or PSY 352/353 or ENR 352/353

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>Major</td>
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<tr>
<td>General Education</td>
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<td>49-50</td>
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<td>Electives</td>
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<td>Total Credits</td>
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Courses whose number is followed by a letter fulfill a General Education requirement.

**COS 100 • Introduction to Programming** 3 Credits.

An introduction to programming using a current procedural (imperative) programming language. Standard data types and control structures are introduced.

*Offered: Fall, Interim.*
COS 313 • Database Systems 3 Credits.
Relational and object-oriented databases, schemas, and normalization. Database management systems, SQL, concurrent transactions, logging/disaster recovery, and query optimization. Application program interaction with database management systems.
Prerequisites: COS 216. Offered: Fall, even # years.

COS 318 • Web Programming 3 Credits.
An examination of the foundational technologies used for creating web applications. Includes client and server programming, as well as fundamentals of cloud services, including security, storage, and reliability.
Prerequisites: COS 216. Special Notes: Some knowledge of HTML and the basics of JavaScript are expected. Offered: Fall.

COS 320 • Computer Graphics Programming 3 Credits.
An introduction to the drawing methods, geometrical transforms, and illumination models that are fundamental to computer graphics programming. Topics include modeling of 2D and 3D objects, local and global illumination simulation, shading, color models, procedural modeling, and discrete (fragment) techniques including texture mapping. A current graphics API is used, including custom shaders.
Prerequisites: COS 216. Offered: Fall, odd # years.

COS 334 • Data Mining and Machine Learning 3 Credits.
An introduction to widely-used techniques for extracting information from large data sets such as medical databases, credit reports, weather history, and the stock market. Includes algorithms for nominal and ordinal data and metrics to measure their performance. Students will implement common algorithms with real data and choose appropriate algorithms for different applications.
Prerequisites: COS 216. Offered: Spring, even # years.

COS 337K • Behavioral Robotics 3 Credits.
Control and automation are fundamental aspects of human, animal, and machine behavior. These topics will be considered from philosophical and psychological perspectives and explored through robotics and other hands-on experimental labs, in order to develop both a practical and theoretical understanding of behavior.
Prerequisites: Laboratory Science (D) course; Mathematics (M) course. Special Note: Carries cross credit in psychology. Offered: Interim.

COS 351 • High-Performance Computing 3 Credits.
Fundamental concepts and techniques for parallel computation in C/C++ (load balancing, communication, synchronization, serial program decomposition) using an industry-standard parallel computing library.
Prerequisites: COS 205, COS 214. Offered: Interim.

COS 371 • Organization of Programming Languages 3 Credits.
Formal programming language specification using various grammars and the Backus-Naur Form. Data types and structures, control structures, and data flow of several programming languages, including interpreters and compilers. Introduction to parsing and lexical analysis.
Prerequisites: COS 216. Offered: Fall, odd # years.

COS 386 • Data Communications and Computer Networks 3 Credits.
Data communications including interprocess communication, computer networking, and associated software protocols. Topics include network topologies, point-to-point network protocols, local area networks, and interconnection of networks.
Prerequisites: COS 301. Offered: Spring, odd # years.

COS 389 • Artificial Intelligence 3 Credits.
Basic concepts and techniques of artificial intelligence, including representation, notational structures, searches, control structures, and logic programming languages. Samples of current work in several application areas including natural language systems, expert systems, and neural networks.
Prerequisites: COS 216. Offered: Spring, odd # years.

COS 420 • Software Process 3 Credits.
Balancing the various real-world challenges that a software engineer encounters, including ambiguity, conflicting requirements, task-time estimation, team dynamics, requests from customers, product managers or architects. A team-based software project on a modern computer science topic will be developed during the semester.
Prerequisites: COS 216. Special Notes: Cross listed with ENR 420. COS 477 is a recommended prerequisite. Offered: Spring, odd # years.
COS 450 • Humans and Computers 3 Credits.
Examines the ways that humans and computers interact. Issues in user experience and human-machine interaction are explored. Christian and professional ethics in the development and application of computing technology are extensively examined.
Prerequisites: COS 216. Offered: Interim, even # years. Special Notes: Students may not receive credit for both COS 450 and GES 334K.

COS 477 • Software Engineering 3 Credits.
Formal approach to the design and development of software. Multiple process models discussed and compared. Other topics include design patterns, project management and estimation, team management, formal methods, documentation, system and data description, verification and validation, and process improvement.
Prerequisites: COS 216. Special Notes: Cross listed with ENR 477. Offered: Fall, odd # years.

COS 490 • Topics in Computer Science 3 Credits.
A seminar to provide an in-depth survey of a recent trend or field in the rapidly changing discipline of computer science. Students work on a significant project and explore the future implications of the current topic.
Prerequisites: COS 216. Offered: Occasionally.