

## Computer Science Concentration Area Courses

All CS Option/Capstone courses are listed below. Students are required to take **three** courses in one specific area, plus a **fourth** CS Option course; this fourth course must be in a different area for all students who started at RPI in Fall 2021 or later. In the areas below, courses shown in *italics* are no longer offered or are being phased out, and courses that meet the communication intensive requirement are marked as [CI]. For any missing courses, contact [goldsd3@rpi.edu](mailto:goldsd3@rpi.edu) with the course syllabus, etc.

| <b>(a) Concentration Area: Theory, Algorithms, and Mathematics (formerly Theory and Algorithms)</b> |  |
|---|--|
| CSCI 4020/6020  | Design and Analysis of Algorithms                      |
| CSCI 4030/6220  | Randomized Algorithms                                  |
| CSCI 4040/6040  | Approximation Algorithms                               |
| CSCI 4100/6100  | Machine Learning from Data                             |
| CSCI 4110/6110 (or CSCI 496x/696x)  | Computational Social Processes                         |
| CSCI 4120/6120  | Computational Finance                                  |
| CSCI 4150   | Introduction to Artificial Intelligence                |
| CSCI 4230/6230  | Cryptography and Network Security I [CI]               |
| CSCI 4250/6250  | Frontiers of Network Science [CI]                      |
| CSCI 4260 (or MATH 4150)  | Graph Theory   |
| CSCI 4420 (or PHIL 4420 or MATH 4030)   | Computability and Logic                                |
| CSCI 4450/6450  | Principles of Program Analysis                         |
| CSCI 4510/6510  | Distributed Systems and Algorithms                     |
| CSCI 4560/6560  | Computational Geometry                                 |
| CSCI 4800 (or MATH 4800)  | Numerical Computing                                    |
| CSCI 4820 (or MATH 4820)  | Introduction to Numerical Methods for Diff. Eqns.      |
| CSCI 496x/696x  | Theory of Computation                                  |
| CSCI 496x   | Intermediate Formal Logic and AI                       |
| CSCI 496x/696x  | ML for Bioinformatics ( <i>Computational Biology</i> ) |
| CSCI 496x (or COGS 4210/6210)   | Cognitive Modeling                                     |
| CSCI 496x/696x  | Parallel Graph Analysis                                |
| CSCI 496x/696x  | Large-Scale Matrix Computation and ML                  |
| CSCI 496x/696x  | Machine Learning and Optimization                      |
| CSCI 496x (or COGS 4410/6410)   | Programming for Cognitive Science and AI               |
| CSCI 496x/696x  | Network Resilience                                     |
| CSCI 496x/696x  | Software Verification                                  |
| CSCI 496x/696x  | Economics and Computation                              |
| CSCI 496x   | Introduction to Network Science                        |
| CSCI 496x/696x  | Computing and Quantum Computing                        |
| CSCI 6800 (or MATH 6800)  | Computational Linear Algebra                           |
| CSCI 6820 (or MATH 6820)  | Numerical Solution of Ordinary Differential Eqns       |
| CSCI 6840 (or MATH 6840)  | Numerical Solution of Partial Differential Eqns        |
| CSCI 6860 (or MATH 6860)  | Finite Element Analysis                                |
| CSCI 496x/696x  | Algorithmic Game Theory                                |
| ECSE 4170/6170  | Modeling & Simulation for Cyber-Physical Systems       |
| ECSE 4850/496x  | Introduction to Deep Learning                          |
| ECSE 496x   | Introduction to Machine Learning                       |
| ECSE 496x/696x  | Quantum Computer Programming                           |
| ECSE 496x/696x  | Networks and Networked Systems                         |
| ECSE 6610   | Pattern Recognition                                    |
| MATH 4840   | Numerical Linear Algebra with Applications             |
| MATP 4820/6610  | Computational Optimization                             |
| MATP 6640   | Linear Programming                                     |

| <b>(b) Concentration Area: Systems and Software</b> |   |
|---|---|
| CSCI 4220   | Network Programming                                     |
| CSCI 4310/6310                                      | Networking in the Linux Kernel <b>[CI]</b>              |
| CSCI 4320/6360                                      | Parallel Programming/Parallel Computing                 |
| CSCI 4380   | Database Systems  |
| CSCI 4440   | Software Design and Documentation <b>[CI]</b>           |
| CSCI 4450/6450                                      | Principles of Program Analysis                          |
| CSCI 4460/6460                                      | Large-Scale Programming and Testing <b>[CI]</b>         |
| CSCI 4470 (or CSCI 496x)                            | Open Source Software                                    |
| CSCI 4500/6500                                      | Distributed Computing over the Internet                 |
| CSCI 4510/6510                                      | Distributed Systems and Algorithms                      |
| CSCI 496x/696x                                      | AI and Blockchain                                       |
| CSCI 496x/696x                                      | Cloud Computing Seminar                                 |
| CSCI 496x/696x (or ITWS 496x)                       | Modern Binary Exploitation (MBE)                        |
| CSCI 496x/696x (or ITWS 4500)                       | Web Science Systems Development                         |
| CSCI 496x (or ECSE 4670)                            | Computer Communication Networks (CCN)                   |
| CSCI 496x   | Application/Advanced Programming using Java <b>[CI]</b> |
| CSCI 496x/696x                                      | Graph Mining  |
| ECSE 4660   | Internetworking of Things                               |
| ECSE 4740   | Applied Parallel Computing for Engineers                |
| ECSE 4770   | Computer Hardware Design (CHD)                          |
| ECSE 4780   | Advanced Computer Hardware Design (ACHD)                |
| ECSE 4790   | Microprocessor Systems (MPS)                            |
| ITWS 4370   | Information System Security                             |

| <b>(c) Concentration Area: Artificial Intelligence and Data</b> |  |
|---|--|
| CSCI 4100/6100  | Machine Learning from Data                             |
| CSCI 4110/6110  | Computational Social Processes                         |
| CSCI 4150   | Introduction to Artificial Intelligence                |
| CSCI 4270/6270  | Computational Vision                                   |
| CSCI 4340/6340  | Ontologies   |
| CSCI 4350/6350 (or ITWS 4350/6350)                              | Data Science   |
| CSCI 4370/6370  | Data and Society [CI]                                  |
| CSCI 4380   | Database Systems                                       |
| CSCI 4390/6390  | Data Mining  |
| CSCI 4400/6400  | Xinformatics   |
| CSCI 4420 (or PHIL 4420 or MATH 4030)                           | Computability and Logic                                |
| CSCI 4480 (or ECSE 4480)  | Robotics I   |
| CSCI 4490/6490 (or ECSE 4490/6490)                              | Robotics II  |
| CSCI 4600/6600 (or ITWS 4600/6600)                              | Data Analytics   |
| CSCI 496x/696x  | Projects in Machine Learning and AI                    |
| CSCI 496x/696x  | Safe Autonomy  |
| CSCI 496x/696x  | Machine Learning for Autonomous Systems                |
| CSCI 496x/696x  | AI and Blockchain                                      |
| CSCI 496x   | Intermediate Formal Logic and AI                       |
| CSCI 496x/696x  | Introduction to Network Science                        |
| CSCI 496x/696x  | Cognitive Computing                                    |
| CSCI 496x (or COGS 4430/6430)                                   | Learning and Advanced Game AI                          |
| CSCI 496x (or COGS 4420)  | Game AI  |
| CSCI 496x/696x (or COGS 4880/6880)                              | Language Endowed Intelligent Agents                    |
| CSCI 496x/696x (or COGS 4640/6640)                              | Intelligent Virtual Agents                             |
| CSCI 496x/696x  | Semantic Web Topics Course                             |
| CSCI 496x/696x  | Knowledge Discovery and Extraction                     |
| CSCI 496x (or COGS 4410/6410)                                   | Programming for Cognitive Science and AI               |
| CSCI 496x (or COGS 4210/6210)                                   | Cognitive Modeling                                     |
| CSCI 496x (or COGS 496x/696x)                                   | Social Computing                                       |
| CSCI 496x/696x  | ML for Bioinformatics ( <i>Computational Biology</i> ) |
| CSCI 496x/696x  | Advanced Web Science                                   |
| CSCI 496x/696x  | Large-Scale Matrix Computation and ML                  |
| CSCI 496x/696x  | Machine Learning and Optimization                      |
| CSCI 496x/696x  | Network Resilience                                     |
| CSCI 496x/696x  | Social Processes and Networks                          |
| CSCI 496x/696x  | Economics and Computation                              |
| CSCI 496x   | AI in Fact and Fiction                                 |
| CSCI 496x   | Information Retrieval                                  |
| ECSE 4850/496x  | Introduction to Deep Learning                          |
| ECSE 496x   | Introduction to Machine Learning                       |
| ECSE 6610   | Pattern Recognition                                    |

| <b>(d) Concentration Area: Applications</b> <i>(formerly Vision, Graphics, Robotics, and Games)</i> |   |
|---|---|
| CSCI 4270/6270  | Computational Vision                              |
| CSCI 4320/6360  | Parallel Programming/Parallel Computing           |
| CSCI 4480 (or ECSE 4480)  | Robotics I  |
| <i>CSCI 4490/6490 (or ECSE 4490/6490)</i>   | <i>Robotics II</i>                                |
| <i>CSCI 4520</i>  | <i>Game Development I (phased out Fall 2019)</i>  |
| CSCI 4530/6530  | Advanced Computer Graphics <b>[CI]</b>            |
| <i>CSCI 4540</i>  | <i>Game Development II (phased out Fall 2021)</i> |
| CSCI 4550/6550  | Interactive Visualization <b>[CI]</b>             |
| CSCI 4560/6560  | Computational Geometry                            |
| CSCI 496x/696x  | Projects in Machine Learning and AI               |
| CSCI 496x (or COGS 4430/6430)   | Learning and Advanced Game AI                     |
| CSCI 496x (or COGS 4420)  | Game AI   |
| CSCI 496x/696x  | Safe Autonomy                                     |
| ECSE 4740   | Applied Parallel Computing for Engineers          |
| <i>ECSE 4750/696x</i>   | <i>Computer Graphics</i>                          |
| ECSE 4620/6620  | Computer Vision for Visual Effects                |
| ECSE 6650   | Computer Vision                                   |
| ECSE 696x   | Robot Dynamics and Control                        |
| GSAS 4550   | Game Architecture                                 |