

## Annex (PhD) – List of Modules in Clusters

*(Cluster revised in Semester 1, AY2021/22; applicable to current PhD CS students)*

### 1. Algorithms and Theory

CS5215 Constraint Programming  
CS5230 Computational Complexity  
CS5234 Combinatorial and Graph Algorithms  
CS5236 Advanced Automata Theory  
CS5237 Computational Geometry and Applications  
CS5238 Advanced Combinatorial Methods in Bioinformatics  
CS5330 Randomized Algorithms  
**CS5461 Algorithmic Mechanism Design** (Aug 2021)  
CS6209 Topics in Cryptography  
CS6234 Advanced Algorithms  
CS6283 Topics in Computer Science: Trustworthy Machine Learning  
CS6283 Topics in Computer Science: Computational Social Science  
CS6283 Topics in Computer Science: Logic in AI  
CS6285 Topics in Computer Science: Pseudorandomness

### 2. Computer Systems: Architecture, Networking, Operating Systems, Parallel Computing, Security

CS5222 Advanced Computer Architecture  
CS5223 Distributed Systems  
CS5224 Cloud Computing  
CS5229 Advanced Computer Networks  
CS5231 Systems Security  
CS5233 Simulation and Modelling Techniques  
CS5239 Computer System Performance Analysis  
CS5248 Systems Support for Continuous Media  
CS5250 Advanced Operating Systems  
CS5272 Embedded Software Design  
CS5321 Network Security  
CS5322 Database Security  
CS5331 Web Security  
CS5332 Biometric Authentication  
CS5422 Wireless Networking  
CS5425 Big Data Systems for Data Science  
CS5439 Software Security  
CS5478 Intelligent Robots: Algorithms and Systems  
CS6204 Advanced Topics in Networking  
CS6209 Topics in Cryptography  
CS6213 Topics in Distributed Computing  
**CS6219 Advanced Topics in Computer Systems** (Aug 2021)  
CS6230 Topics in Information Security  
CS6280 Topics in Computer Science: Datacentre Software Dynamics  
CS6282 Topics in Computer Science: Analytical Performance Modeling for Computer Systems  
CS6280 Topics in Computer Science: Systems Design for Next Gen Hardware  
CS6285 Topics in Computer Science: Bridging System and Deep Learning  
CS6211 Analytical Performance Modelling for Computer Systems  
CS6231 Topics in System Security  
CS6284 Topics in Computer Science: Big Data Meets New Hardware

### 3. Knowledge Systems: Artificial Intelligence, Computational Biology, Database

CS5215 Constraint Programming  
CS5228 Knowledge Discovery and Data Mining  
CS5233 Simulation and Modelling Techniques  
CS5238 Advanced Combinatorial Methods in Bioinformatics  
CS5242 Neural Networks and Deep Learning  
CS5246 Text Mining  
**CS5260 Neural Networks and Deep Learning II** (Aug 2021)  
CS5339 Theory and Algorithms for Machine Learning  
CS5340 Uncertainty Modelling in AI  
CS5344 Big-Data Analytics Technology  
CS5421 Database Applications Design and Tuning  
CS5424 Distributed Databases  
CS5425 Big Data Systems for Data Science  
CS5446 AI Planning and Decision Making  
**CS5477 3D Computer Vision** (Aug 2021)  
CS5478 Intelligent Robots: Algorithms and Systems  
**CS5562 Trustworthy Machine Learning** (Aug 2021)  
CS6203 Advanced Topics in Database Systems  
CS6207 Advanced Natural Language Processing  
CS6208 Advanced Topics in Artificial Intelligence  
CS6216 Advanced Topics in Machine Learning  
CS6220 Advanced Topics in Data Mining  
CS6222 Topics in Computational Biology  
CS6244 Robot Motion Planning and Control  
CS6281 Topics in Computer Science: User Generated Content Analyses using Automated Discourse Processing  
CS6281 Topics in Computer Science: Human-Centric AI  
CS6283 Topics in Computer Science: Logic in AI  
CS6283 Topics in Computer Science: Trustworthy Machine Learning  
CS6285 Topics in Computer Science: Bridging System and Deep Learning  
CS6284 Topics in Computer Science: Big Data Meets New Hardware

### 4. Media Technologies: Information Retrieval, HCI, Speech and Language, Graphics, Vision, Multimedia Applications

CS5237 Computational Geometry and Applications  
CS5240 Theoretical Foundations in Multimedia  
CS5241 Speech Processing  
CS5242 Neural Networks and Deep Learning  
CS5246 Text Mining  
CS5248 Systems Support for Continuous Media  
CS5332 Biometric Authentication  
CS5346 Information Visualisation  
**CS5477 3D Computer Vision** (Aug 2021)  
CS6243 Computational Photography  
CS5343 Advanced Computer Animation  
CS6206 Advanced Topics in Human-Computer Interaction  
CS6207 Advanced Natural Language Processing  
CS6212 Topics in Media  
CS6240 Multimedia Analysis  
CS6241 Advanced Topics in Computer Graphics  
**CS6281 Topics in Computer Science: Immersive Videos** (Aug 2021)

## **5. Programming Language and Software Engineering**

CS5214 Design of Optimising Compilers  
CS5215 Constraint Programming  
CS5218 Principles of Program Analysis  
CS5219 Automated Software Validation  
CS5232 Formal Specification and Design Techniques  
CS5272 Embedded Software Design  
CS5439 Software Security  
CS6202 Advanced Topics in Programming Languages  
CS6215 Advanced Topics in Program Analysis  
CS6880 Advanced Topics in Software Engineering