

# Appendix A

## ECE Research Clusters and Associated Coursework

The Department of Electrical and Computer Engineering organizes its doctoral curriculum and qualifying examination preparation around the following four research clusters:

### 1. AI-Powered Microchips and Systems

- Core courses
  1. ECE 637 Principles of Artificial Intelligence
  2. ECE 648 Machine Learning
  3. ECE 653 Neural Networks
  4. ECE 725 Statistical Signal Processing
  5. ECE 699 Special Topics in Electrical Engineering (signal processing courses)
- Elective courses
  1. ECE 606 Microfabrication
  2. ECE 610 Software Requirements and Interaction Design
  3. ECE 612 Software Architecture and Design
  4. ECE 632 VLSI Systems
  5. ECE 646 Reliable Digital System Design
  6. ECE 649 Generative AI
  7. ECE 650 Trustworthy AI
  8. ECE 735 Fundamentals of Network Science
  9. ECE 730. Statistical Learning
  10. ISE 617 Reinforcement Learning and Decision Making Under Uncertainty
  11. ISE 765 Advanced Production Systems
  12. MTH 642 Statistical Analysis

### 2. Robotics and Autonomous Systems

- Core courses
  1. ECE 670 Robotics and Intelligent Systems
  2. ECE 671 Robotic Studio Lab
- Elective courses
  1. ECE 638 Introduction to Digital Image Processing
  2. ECE 648 Machine Learning
  3. ECE 738 Computer Vision
  4. ECE 753 Pattern Recognition and Neural Networks
  5. BME 610 Introduction to Medical Robotics
  6. ISE 605 Robotics

### 3. Quantum and Nano Technologies

- Core courses
  1. ECE 642 MEMS: Sensors and Electronics
  2. ECE 643 BioNanotechnology
  3. ECE 721 Quantum Computing XXX
- Elective courses
  1. ECE 606 Microfabrication
  2. ECE 632 VLSI Systems
  3. ECE 722 Magnetic Devices and Materials
  4. CAE 729 Molecular Modeling of Materials
  5. MAE 601 Methods of Engineering Analysis
  6. MAE 687 Fundamentals of Microfabrication
  7. PHY 660 Quantum Mechanics I
  8. PHY 661 Quantum Mechanics II

9. PHY 752 Electromagnetic Theory I
  10. PHY 753 Electromagnetic Theory II
4. **Cybersecurity and Cyber Physical Systems**
- Core courses
    1. ECE676 Internet and Intranet Security
    2. ECE 673 Information Assurance
  - Elective courses
    1. ECE 632 VLSI Systems
    2. ECE 646 Reliable Digital System Design
    3. ECE 634 Communication Networks
    4. ECE 675 Digital Forensics
    5. ECE 678 Network Security
    6. ECE 721 Quantum Computing
    7. ECE 753 Pattern Recognition and Neural Networks

Each research cluster contains a curated set of core graduate courses and approved electives that provide the technical foundation needed for the qualifying examination and subsequent dissertation research. Students, in consultation with their advisor, must select one research cluster and complete at least 6 credits of core coursework and 6 credits of elective coursework from that cluster prior to taking the qualifying examination.

A complete list of courses under each cluster will be provided by the Graduate Program Director in consultation with the faculty and will be updated periodically to reflect developments in departmental research and curriculum.