Academic Requirements for First Year PhD Comprehensive Exam in ECE

The ECE Department’s PhD graduate research program is partitioned into three main areas of concentration and research:

A. **Signals and Communications** – including the following graduate level courses:
   1) ECE 410 Introduction to Augmented and Virtual Reality
   2) ECE 433 Probabilistic Models for Inference and Estimation
   3) ECE 440 Introduction to Random Processes
   4) ECE 441 Detection & Estimation Theory
   5) ECE 442 Network Science Analytics
   6) ECE 444 Digital Communications
   7) ECE 445 Wireless Communications
   8) ECE 446 Digital Signal Processing
   9) ECE 447 Digital Image Processing
   10) ECE 448 Wireless Sensor Networks
   11) ECE 449 Machine Vision
   12) ECE 450 Information Theory
   13) ECE 451 (BME 451) Biomedical Ultrasound
   14) ECE 452 (BME 453) Medical Imaging-Theory and Implementation
   15) ECE 453 Ultrasound Imaging
   16) ECE 457 Digital Video Processing
   17) ECE 471 Computational Models of Musical Processes
   18) ECE 472 Audio Signal Processing
   19) ECE 473 Computational Methods of Music
   20) ECE 475 Audio Software Design I
   21) ECE 476 Audio Software Design II
   22) ECE 477 Computer Audition
   23) ECE 479 Audio Recording – Technology and Fundamentals

B. **Integrated Electronics and Computer Engineering** – including the following graduate level courses:
   1) ECE 400 Computer Organization
   2) ECE 401 Advanced Computer Architecture
   3) ECE 402 Memory Systems
   4) ECE 404 Microprocessor Architecture
   5) ECE 406 Introduction to Parallel Computing Using GPU's
   6) ECE 409 (CSC 446) Machine Learning
   7) ECE 413 Intro. to Hardware Security
   8) ECE 429 Audio Electronics
   9) ECE 431 Computational Methods
   10) ECE 455 Software Analysis and Improvement
   11) ECE 461 Intro to VLSI
   12) ECE 462 Advanced CMOS VLSI Design
   13) ECE 463 VLSI Error Control Systems
   14) ECE 464 Fundamentals of VLSI Testing
   15) ECE 465/565 Performance Issues in VLSI/IC Design & Analysis
   16) ECE 466 RF and Microwave Integrated Circuits
   17) ECE 467 Advanced Analog Integrated Circuit Design
   18) ECE 468 Advanced Analog CMOS Integrated Circuit Design II
   19) ECE 469 High Speed Integrated Electronics
Physical Electronics, Electromagnetism, and Acoustics – including the following graduate level courses:

1) ECE 421 (OPT 421) Optical Properties of Materials
2) ECE 422 Nanoelectronic Devices
3) ECE 423 Semiconductor Devices
4) ECE 424 Intro to Cond Matter Physics
5) ECE 426 (OPT 468) Waveguides & Optoelectronic Devices
6) ECE 428 (OPT 425) Radiation and Detectors
7) ECE 432 Acoustic Waves
8) ECE 433 Musical Acoustics
9) ECE 434 Microelectromechanical Systems
10) ECE 435 Introduction to Opto-Electronics
11) ECE 436 Nanophotonic and Nanomechanical Devices
12) ECE 438 Nonlinear Acoustics
13) ECE 439 Spatial Audio NEW
14) ECE 470 Digital Audio Effects NEW
15) ECE 474 (BME 474) Biomed Sensors, Circuits & Instrumentation
16) ECE 520 Spin-based electronics: theory, devices & applications

All first year PhD students must satisfy the following requirements for continuation in the PhD program:

1. **2+1+1 Course Requirement**: All PhD students must take and pass at least 2 graduate level courses (400-level) from their respective concentration area and at least one graduate level course from each of the two remaining areas. The courses must be taken during the first year of study\(^1\). The specific courses are to be selected by the students in agreement with their research advisors.

2. **Comprehensive Exam**: All PhD students must take an oral exam before the end of their third semester of full-time study\(^1\). The format of the oral exam (e.g., a question/answer session, a paper presentation or both) shall be determined by the Academic Advisor and shall be conducted in front of at least two faculty in the respective research area. The Advisor and/or Graduate Program Coordinator will provide general guidelines on what is expected of them for the exam. Upon completion of the oral exam, the exam committee shall provide the examination results to the Graduate Program Coordinator to be included in student’s academic record. The exam committee shall provide their recommendation at the conclusion of the oral exam, specifically if the student should be allowed to continue to the next stage of their graduate program, if remedial work is required and the exam re-taken, or if the student should not continue in the PhD program. Final action will be taken after the recommendation is approved by the Graduate Program Coordinator and the Department Chair.

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\(^1\) Students may petition to extend the time for completing these requirements. It is expected that part-time students and those with a non-ECE background may need additional time.