Ph.D. in Computer Science

PROPOSAL to
Remove the "Concentration Areas" (exact text to be removed is included below).

The information about "Concentration Areas" is at least 10 years old and has been propagated from one catalog year to the next, just because of Registrar inertia. **We have not been using these "Concentration Areas"** (at least not in the past 10 years), and they are quite outdated (many relevant courses have been introduced meanwhile, some of the courses listed there have not been taught in many years).

Text to be removed:

Concentration Areas

A PhD student within the program is required to pick an area of concentration. While the areas of concentrations change according to faculty research interests, here are examples of possible concentrations with possible courses taken within those concentrations.

Computational Biology and Bioinformatics

Code	Title	Credits
CS 631	Data Management System Design	3
CS 632	Advanced Database System Design	3
CS 634	Data Mining	3
CS 665	Algorithmic Graph Theory	3
CS 667	Design Techniques for Algorithms	3
CS 670	Artificial Intelligence	3
BIOL 601	Computational Biology I	3
CS 744	Data Mining and Management in Bioinformatics	3

Course List

Computer Algorithms and Theory of Computing

Code	Title	Credits
CS 610	Data Structures and Algorithms	3
CS 611	Introduction to Computability and Complexity	3

Code	Title	Credits
CS 665	Algorithmic Graph Theory	3
CS 667	Design Techniques for Algorithms	3
CS 668	Parallel Algorithms	3
IE 704	Sequencing and Scheduling	3

Course List

Computer Systems, and Parallel and Distributed Processing

Code	Title	Credits
CS 630	Operating System Design	3
CS 633	Distributed Systems	3
CS 650	Computer Architecture	3
CS 643	Cloud Computing	3
CS 668	Parallel Algorithms	3
CS 750	High Performance Computing	3
ECE 658	VLSI Design I	3
ECE 758	VLSI Design II	3
ECE 689	Computer Arithmetic Algorithms	3
ECE 785		3

Course List

Databases, Data Mining, and Knowledge-Based Engineering

Code	Title	Credits
CS 630	Operating System Design	3
CS 631	Data Management System Design	3
CS 632	Advanced Database System Design	3
CS 634	Data Mining	3
CS 665	Algorithmic Graph Theory	3
CS 667	Design Techniques for Algorithms	3
CS 670	Artificial Intelligence	3
CS 731	Applications of Database Systems	3
CS 744	Data Mining and Management in Bioinformatics	3

Course List

Image Processing and Computer Graphics

Code	Title	Credits
CS 630	Operating System Design	3
CS 632	Advanced Database System Design	3

Code	Title	Credits
CS 657	Principles of Interactive Computer Graphics	3
CS 659	Image Processing and Analysis	3
CS 665	Algorithmic Graph Theory	3
CS 667	Design Techniques for Algorithms	3
CS 759	Advanced Image Processing and Analysis	3
CS 782	Pattern Recognition and Applications	3
ECE 601	Linear Systems	3
ECE 643	Digital Image Processing I	3
ME 635	Computer-Aided Design	3

Other 600/700-level courses as approved by advisor.

Course List

Networking and Security

Code	Title	Credits
CS 630	Operating System Design	3
CS 651	Data Communications	3
CS 652	Computer Networks-Architectures, Protocols and Standards	3
CS 656	Internet and Higher-Layer Protocols	3
CS 696	Network Management and Security	3

Course List

Software Engineering

Code	Title	Credits
CS 610	Data Structures and Algorithms	3
CS 611	Introduction to Computability and Complexity	3
CS 630	Operating System Design	3
CS 635	Computer Programming Languages	3
CS 667	Design Techniques for Algorithms	3
CS 673	Software Design and Production Methodology	3
IS 676	Requirements Engineering	3
IS 683	Web Systems Development	3

Course List

Systems Analysis, Simulation and Modeling

Code	Title	Credits
CS 621	Numerical Analysis I	3
CS 630	Operating System Design	3

Code	Title	Credits
CS 631	Data Management System Design	3
CS 651	Data Communications	3
CS 661	Systems Simulation	3

Course List

Proposal for a Revised Degree Program: Departmental Approvals

NJIT
New Jersey's Science &
Technology University

Degree Program Revision (include name): Engineering Science College: NCE   Dept: NCE

Date Proposed: __January 30, 2019__

Departmental Approval (include name) and Date: __January 30, 2019__

Dean's Approval and Date: _____

Date to be presented to the Committee on Graduate Education: __February 14, 2019__

Additional Approvals and Dates (if any): (see below) _____

Department Chair	Signature and Date
Moshe Kam	
Sui-Hoi Edwin How	

When will the revision be offered?

☐ Spring 20<u>19</u>   ☐ Summer 20_   ☐ Fall 20

MS in Engineering Science

Degree Requirements

To ensure academic success in their graduate studies, students may be required to take additional undergraduate or graduate courses before beginning graduate curricula. This program of bridge courses will be individually-designed in consultation with the student's graduate advisor. Such courses are not counted toward degree requirements.

A minimum of 30 credits is required. A thesis or project may be included.

Seminar: In addition to the minimum 30 degree credits, all students who receive departmental or research-based awards must enroll each semester in a graduate seminar. The seminar is selected in consultation with the graduate advisor.

M.S. in Engineering Science (courses only)

Course List		
Code	**Title**	**Credits**
Required		
MATH 6XX	Two 600-level math courses	6
One 600-level physics, chemistry, or biology course		3
Two 600-level engineering courses		6
Electives [1]		
Select five courses in consultation with graduate advisor		15
Total Credits		30

[1] The elective credits must form a meaningful and coherent program integrated with the specialization in science or engineering.

M.S. in Engineering Science (Master's project)

Course List		
Code	**Title**	**Credits**
Required		
MATH 6XX	Two 600-level math courses	6
One 600-level physics, chemistry, or biology course		3
Two 600-level engineering courses		6
Project		
Master's project		3
Electives [1]		
Select four courses in consultation with graduate advisor		12
Total Credits		30

[1] The elective credits must form a meaningful and coherent program integrated with the specialization in science or engineering.

M.S. in Engineering Science (Master's thesis)

Course List		
Code	**Title**	**Credits**
Required		
MATH 6XX	Two 600-level math courses	6
One 600-level physics, chemistry, or biology course		3
Two 600-level engineering courses		6
Thesis		
Master's thesis		6
Electives [1]		
Select three courses in consultation with graduate advisor		9
Total Credits		30

[1] The elective credits must form a meaningful and coherent program integrated with the specialization in science or engineering.

M.S. in Cyber Security and Privacy

Academic Advisor: http://computing.njit.edu/academic-advising/

Degree Requirements

An MSCSP (M.S. in Cyber Security and Privacy) course program must satisfy the following distribution requirement:

- 30 credits are required, which can be satisfied as either one of the following options:
  - Courses (30 credits)
  - Courses (27 credits) + MS Project (3 credits)
  - Courses (24 credits) + MS Thesis (6 credits)
- All Core courses are required.
- At most two courses can be Foundational courses.
- At most two courses can be chosen from outside the Department of Computer Science.

If a student chooses the MS project or MS thesis option, the project or thesis must be related to cyber security.

Students with non-computing STEM background may be accepted and required to take the following bridge courses (CS 506 may count toward the credits required for the MS degree):

Code	Title	Credits
Bridge Courses		
CS 280	Programming Language Concepts	3
CS 332	Principles of Operating Systems	3
CS 505	Programming, Data Structures, and Algorithms	3
CS 506	Foundations of Computer Science	3
Total Credits		**12**

Course List

M.S. in Cyber Security and Privacy (courses only)

Code	Title	Credits
Core Course Requirements		
CS 608	Cryptography and Security	3
CS 645	Security and Privacy in Computer Systems	3
CS 646	Network Protocols Security	3
CS 647	Counter Hacking Techniques	3
CS 656 or ECE 637	Internet and Higher-Layer Protocols [1] Internet and Higher-Layer Protocols	3

Code	Title	Credits
CS 696	Network Management and Security [1]	3
or ECE 638	Network Management and Security	
Electives and Foundation Courses		**12**
Electives		
CS 633	Distributed Systems	
CS 634	Data Mining	
CS 643	Cloud Computing	
CS 660	Digital Watermarking	
CS 673	Software Design and Production Methodology	
CS 678	Smartphone Security and Reliability	
CS 680	Linux Kernel Programming	
CS 684	Software Test & Qual Assurance	
CS 708	Advanced Data Security and Privacy	
CS 755	Security and Privacy in Wireless Networks	
IS 680	Information Systems Auditing	
IS 681	Computer Security Auditing	
IS 682	Forensic Auditing for Computing Security	
IS 687	Transaction Mining and Fraud Detection	
IT 620	Wireless Networks Security and Administration	
IT 640	Network Services Administration	
ECE 636	Computer Networking Laboratory	
MGMT 688	Information Technology, Business and the Law	
MGMT 691	Legal and Ethical Issues	
Foundational Courses		
CS 610	Data Structures and Algorithms	
CS 630	Operating System Design	
CS 631	Data Management System Design	
Total Credits		**30**

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Course List

[1] Substitution allowed only for students with ECE background and with the permission of the graduate advisor.

M.S. in Cyber Security and Privacy (Master's project option)

Code	Title	Credits
Core Course Requirements		
CS 608	Cryptography and Security	3

Code	Title	Credits
CS 645	Security and Privacy in Computer Systems	3
CS 646	Network Protocols Security	3
CS 647	Counter Hacking Techniques	3
CS 656 or ECE 637	Internet and Higher-Layer Protocols Internet and Higher-Layer Protocols	3
CS 696 or ECE 638	Network Management and Security Network Management and Security	3
Project		
CS 700B	Master's Project [1]	3
Electives and Foundation Courses		**9**
Electives		
CS 633	Distributed Systems	
CS 634	Data Mining	
CS 643	Cloud Computing	
CS 660	Digital Watermarking	
CS 673	Software Design and Production Methodology	
CS 678	Smartphone Security and Reliability	
CS 680	Linux Kernel Programming	
CS 684	Software Test & Qual Assurance	
CS 708	Advanced Data Security and Privacy	
CS 755 or ECE 782	Security and Privacy in Wireless Networks	
IS 680	Information Systems Auditing	
IS 681	Computer Security Auditing	
IS 682	Forensic Auditing for Computing Security	
IS 687	Transaction Mining and Fraud Detection	
IT 620	Wireless Networks Security and Administration	
IT 640	Network Services Administration	
ECE 636	Computer Networking Laboratory	
MGMT 688	Information Technology, Business and the Law	
MGMT 691	Legal and Ethical Issues	
Foundational Courses		
CS 610	Data Structures and Algorithms	
CS 630	Operating System Design	

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Code	Title	Credits
CS 631	Data Management System Design	
Total Credits		**30**

Course List

[1] The project must be related to cyber security.

[2] Substitution allowed only for students with ECE background and with the permission of the graduate advisor.

M.S. in Cyber Security and Privacy (Master's thesis option)

Code	Title	Credits
Core Course Requirements		
CS 608	Cryptography and Security	3
CS 645	Security and Privacy in Computer Systems	3
CS 646	Network Protocols Security	3
CS 647	Counter Hacking Techniques	3
CS 656	Internet and Higher-Layer Protocols [2]	3
or ECE 637	Internet and Higher-Layer Protocols	
CS 696	Network Management and Security [2]	3
or ECE 638	Network Management and Security	
Thesis		
CS 701C	Master's Thesis [1]	6
Electives and Foundation Courses		**6**
Electives		
CS 633	Distributed Systems	
CS 634	Data Mining	
CS 643	Cloud Computing	
CS 660	Digital Watermarking	
CS 673	Software Design and Production Methodology	
CS 678	Smartphone Security and Reliability	
CS 680	Linux Kernel Programming	
CS 684	Software Test & Qual Assurance	
CS 708	Advanced Data Security and Privacy	
CS 755	Security and Privacy in Wireless Networks	
or ECE 782		
IS 680	Information Systems Auditing	
IS 681	Computer Security Auditing	
IS 682	Forensic Auditing for Computing Security	

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Code	Title	Credits
IS 687	Transaction Mining and Fraud Detection	
IT 620	Wireless Networks Security and Administration	
IT 640	Network Services Administration	
ECE 636	Computer Networking Laboratory	
MGMT 688	Information Technology, Business and the Law	
MGMT 691	Legal and Ethical Issues	
Foundational Courses		
CS 610	Data Structures and Algorithms	
CS 630	Operating System Design	
CS 631	Data Management System Design	
Total Credits		**30**

Course List

¹ The thesis must be related to cyber security.

² Substitution allowed only for students with ECE background and with the permission of the graduate advisor.

Master of Science in Cyber Security and Privacy (CSP) - Cyber Defense Option

The objective of the Cyber Defense Professional Science Master (PSM), an option of the MS CSP, is to create leaders with strong communication and management skills in addition to the strong technical knowledge in security and privacy of computer systems, networks and web applications. This PSM is designed for working professionals or students who already have acquired some professional experience. The Cyber Defense PSM is affiliated with the PSM National Office.

A student in the MS CSP – Cyber Defense Option must satisfy the following distribution of requirements:

- 36 credits are required.
- All Cybersecurity Core courses are required (21 credits)
- The rest of 15 credits must be taken from the combined list of PTC (Professional and Technical Communications), Management, and Computing electives, with at least 3 credits, and no more than 6, from each of the 3 elective lists

Among the required Cybersecurity Core courses, the program includes an MS Project, CS 700B. These projects are part of a project course, supervised by a CS faculty member, and done in collaboration with industrial partners. These partners will propose projects, and they will co-supervise the students together with the instructor of the course. Students who have a job are allowed to work on projects from their companies, in which case their employer will be actively engaged in the project supervision. The projects will generally be done in teams of 3 students.

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Code	Title	Credits
Core Course Requirements:		**21**
CS 608	Cryptography and Security	3
CS 645	Security and Privacy in Computer Systems	3
CS 646	Network Protocols Security	3
CS 647	Counter Hacking Techniques	3
CS 656	Internet and Higher-Layer Protocols	3
CS 696	Network Management and Security	3
CS 700B	Master's Project	3

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PTC (Professional and Technical Communications) Courses

Code	Title
PTC 601	Advanced Professional and Technical Communication
PTC 620	Proposal Writing
PTC 622	Working in Teams: Collaborative and Interpersonal Communications
PTC 624	Professional and Technical Editing
PTC 628	Analyzing Social Networks
PTC 629	Theory and Practice of Social Media
PTC 632	Content Management and Information Architecture

Management Courses

Code	Title
ACCT 615	Management Accounting
EM 636	Project Management
FIN 600	Corporate Finance I
MGMT 641	Global Project Management
MGMT 650	Knowledge Management
MGMT 682	Business Research Methods I
MGMT 688	Information Technology, Business and the Law
MGMT 691	Legal and Ethical Issues

Cybersecurity Elective Courses

Code	Title
CS 610	Data Structures and Algorithms
CS 630	Operating System Design
CS 631	Data Management System Design
CS 632	Advanced Database System Design
CS 634	Data Mining
CS 643	Cloud Computing
CS 660	Digital Watermarking

Code	Title	Credits
CS 673	Software Design and Production Methodology	
CS 700B	Master's Project	
CS 678	Smartphone Security and Reliability	
CS 684	Software Test & Qual Assurance	
CS 708	Advanced Data Security and Privacy	
CS 755 or ECE 782	Security and Privacy in Wireless Networks	
IS 680	Information Systems Auditing	
IS 681	Computer Security Auditing	
IS 682	Forensic Auditing for Computing Security	
IT 620	Wireless Networks Security and Administration	
IT 640	Network Services Administration	
ECE 636	Computer Networking Laboratory	

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MS Degree in Pharmaceutical Engineering

The master's degree is a valued professional credential, offered on a full-time or part-time basis. Applicants are expected to have a baccalaureate degree in chemical engineering or equivalent with a minimum GPA of 3.0. Students with undergraduate degrees in biology, chemistry, physics, and equivalent may also be admitted on condition that additional bridge courses may be required. International students must achieve a TOEFL score of at least 550 (paper-based); 213 (computer-based); 79 (internet-based). A quantitative section of GRE must be at the level approved by NCE, presently at 155.

Thirty credit hours are required for the degree. A thesis is optional.

Core courses (5 courses=15 credits):
- ChE 612   Kinetics of Reactions and Reactor Design
- ChE 624   Transport Phenomena
- PhEn 601   Principles of Pharmaceutical Engineering
- PhEn 603   Pharmaceutical Unit Operations: Processing of Liquid and Dispersed-Phase Systems
- PhEn 618   Principles of Pharmacokinetics and Drug Delivery

Select at least one from these courses (1 course=3 credits):
- CHE 714   Micromechanics of particle technology processes
- ChE 611   Thermodynamics
- ChE ~~709~~603   ~~Advanced Separation Processes~~ Separation Process Principles

Select at least one from these courses (1 course=3 credits):
- PhEn 602   Pharmaceutical Facility Design
- PhEn 604   Validation and Regulatory Issues in the Pharmaceutical Industry
- PhEn 605   Pharmaceutical Packaging Technology

Select __any combination__ of three elective courses/thesis courses/project course from the following list (3 courses=9 credits):
- Any of the courses already listed above but not yet taken
- Any courses from the programs specified below:
    - Pharmaceutical Engineering (PhEn) (such as courses not taken already)
    - Chemical Engineering (ChE)
    - Biomedical Engineering (BME)
    - Biology (BIOL)
    - Chemistry (CHEM)
    - Biopharmaceutical Engineering (PhB)
    - Pharmaceutical Materials Processing (PhMP)
    - Pharmaceutical Systems Management
    - Industrial Engineering (IE)
    - Engineering Management (EM)
    - Mathematics (MATH)
- Project/Independent Study (3 credits)
- Thesis courses (6 credits)

M.S. in Software Engineering

Academic Advisor: http://computing.njit.edu/academic-advising/

The program requires the completion of 33 credits.

Students with non-computing STEM background may be accepted and required to take the following bridge courses (CS 506 may count toward the credits required for the MS degree):

Course List		
Code	**Title**	**Credits**
Bridge Courses		
CS 280	Programming Language Concepts	3
CS 332	Principles of Operating Systems	3
CS 505	Programming, Data Structures, and Algorithms	3
CS 506	Foundations of Computer Science	3
Total Credits		12

[1] Students can take other CS courses with advisor approval

Course List		
Code	**Title**	**Credits**
Required Courses		
Students must take a two-course sequence (CS 690 in the Fall followed by CS 700B in the following Spring) that focuses on a team-based industrial scale software project.		

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CS 684	Software Testing and Quality Assurance [1]	3
CS 685	Software Architecture [1]	3
CS 683	Software Project Management [1]	3
IS 676	Requirements Engineering	3
CS 673	Software Design and Production Methodology [1]	3
CS 690	Software Studio	3

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CS 700B	Master's Project	3

Elective Courses

Select ~~five~~ four of the following: 12

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CS 602	Java Programming
CS 630	Operating System Design [1]
CS 631	Data Management System Design [1]
CS 632	Advanced Database System Design
CS 633	Distributed Systems [1]
CS 634	Data Mining
CS 635	Computer Programming Languages
CS 652	Computer Networks-Architectures, Protocols and Standards [1]
CS 656	Internet and Higher-Layer Protocols [1]
CS 659	Image Processing and Analysis

Course List

Code	Title	Credits
CS 670	Artificial Intelligence	
CS 675	Machine Learning	
CS 696	Network Management and Security [1]	
IS 690	Web Services and Middleware	
IS 663	System Analysis and Design	
EM 636	Project Management	
EM 637	Project Control	
MGMT 620	Management of Technology	
Total Credits		33

[1] Students can take other CS courses with advisor approval

Ph.D. in Urban Systems

The Joint PhD Program in Urban Systems offers students opportunities to examine the complex relationships between physical, cultural, ecological, political, social, and economic aspects of cities in the U.S. and other countries, and to specialize in those topics of particular interest to them. With the exception of students pursuing a specialization in Urban History, the research approach in the program is based in the social sciences. Two senior public research universities in Newark co-sponsor the program: New Jersey Institute of Technology and Rutgers University-Newark. All students in the program have full access to library, computing, and other student services at both campuses.

The program gives students the tools to develop research-based knowledge in urban systems, to take an analytic view toward urban problems and to participate in the development and evaluation of policy and services for urban populations. The program consists of two tracks and one sub-specialization: (1) Urban Environment and a possible sub-specialization in Urban History in the School of Architecture at NJIT and (2) Global Urban Studies in the School of Arts and Sciences at Rutgers-Newark. All students in the program complete a 51-credit curriculum.

Urban Environment Track

Students in this track come to the program with previous degrees in architecture, landscape architecture, urban planning, political science and economics. Once in the program, they focus on the physical and spatial aspects of cities and larger metropolitan areas, taking a contemporary perspective, a historical perspective or a combination of both. They choose dissertation topics in architecture, landscape architecture, urban design, infrastructure, urban development, and urban agriculture, and pursue those topics in relation to social, cultural, ecological, and regulatory issues. Those who choose a sub-specialization in Urban History take courses in research methods related to that while other students in the track take research methods courses in the social sciences.

For information about Global Urban Studies at Rutgers-Newark, please see https://sasn.rutgers.edu/academics-admissions/graduate-programs/global-urban-studies-gus.

Admission to the Program

Criteria for admission to the program include a record of academic achievement, previous research experience, and a clear expression of research interests that are compatible with faculty expertise in the two universities. A completed master's degree is normally required of all applicants. Those applying directly from a Bachelor's degree program must have a cumulative undergraduate GPA of 3.75 or higher.

Students who are interested in the Urban Environment Track (including a specialization in Urban History) apply to NJIT (http://www.njit.edu/admissions/how-apply-graduate-admissions). Those interested in Global Urban Studies apply to Rutgers-Newark (https://sasn.rutgers.edu/academics-admissions/graduate-programs/global-urban-studies-gus). Acceptance into the program is decided jointly by coordinators of the two tracks.

The following items are required for application to the Urban Environment Track at NJIT:

Scores from the Graduate Record Examination (GRE)
Scores from Test of English as a Foreign Language (TOEFL) for international students
Official transcripts of all prior academic work
Three letters of recommendation (faculty preferred)
Written statement of purpose, including description of research interests
Interview (optional, at the discretion of track director)

More Information

For questions regarding the Urban Environment Track at NJIT please contact:

Fred Little, Graduate Program & Admissions Coordinator, School of Architecture, little@njit.edu 973.642.7576

Karen A. Franck, Professor, Coordinator of Urban Environment Track, School of Architecture, franck@njit.edu 347-229-2418.

For questions regarding the Global Urban Studies track at Rutgers-Newark, please contact the track coordinators:

Jamie Lew, Associate Professor, Department of Sociology and Anthropology, jamieLew@rutgers.edu 973-353-5130

Mara Sydney, Associate Professor, Department of Political Science, 973-353-5787 msidney@rutgers.edu

Degree Requirements

The curriculum for all Urban Systems students consists of a 9-credit core curriculum, a 12-credit research core, 18-credits of elective courses and a 12-credit dissertation sequence. Following completion of the core curriculum and the two required research courses, all students in the program must take and pass the qualifying examination in order to advance to doctoral candidacy and dissertation. Admission to the Urban Systems PhD Program is not a guarantee of success on the qualifying examination, or a guarantee of advancement to doctoral candidacy.

PhD Faculty, NJIT

Maurie Cohen, Professor, Department of Humanities, PhD, University of Pennsylvania

Zeynep Celik, Distinguished Professor, School of Architecture, PhD, University of California--Berkeley

Gabrielle Esperdy, Associate Professor, School of Architecture, PhD, City University of New York

Karen A. Franck, Professor, School of Architecture, PhD, City University of New York

Neil Maher, Professor, Federated Department of History, PhD, New York University

Stephen Pemberton, Professor, Federated Department of History, PhD, University of North Carolina at Chapel Hill

Anthony Schuman, Professor, School of Architecture, M.Arch, Columbia University

Darius Sollohub, Associate Professor, School of Architecture, M.Arch, Columbia University

Georgeen Theodore, Professor, School of Architecture, M. Arch, Harvard University

PhD Faculty, Rutgers Newark

Leyla Amzi-Erdogdular, Assistant Professor, Federated Department of History, PhD, Columbia University

Ariane Chebel d'Appolonia, Professor, School of Public Affairs and Administration, PhD, Institut d'Etudes Politiques de Paris

Jamie Lew, Associate Professor, Department of Sociology and Anthropology, PhD, Teachers College, Columbia University

Sean T. Mitchell. Associate Professor, Department of Anthropology and Sociology, PhD, University of Chicago

Arthur Powell, Associate Professor, Department of Urban Education, PhD, Rutgers University, New Brunswick

Alan Sadovnik, Board of Governors Distinguished Service Professor, School of Public Affairs and Administration PhD, New York University

Mara Sydney, Associate Professor, Department of Political Science, PhD, University of Colorado

Nükhet Varlık, Associate Professor, Federated Department of History, PhD, University of Chicago

Urban Systems Curriculum (all courses are three credits)	Semester	University
Core (9 credits)		
History of the Global Metropolis (Arch 662-102) OR The Good City (USYS 711)	Fall	NJIT
Globalization, International Migration and Contemporary Cities (RU 26:834:690) OR Urban Governance in Global Perspective (RU 26:977:624:02)	Fall	Rutgers

Urban Theory and the Contemporary City (Arch 662-102)	Spring	NJIT/Rutgers
The Good City: Environmental Design and the Quality of Urban Life (USYS 711) OR History of the Global Metropolis (Arch 662-101)	Spring	NJIT
Urban Governance in Global Perspective (RU 26:977:624:02) OR Globalization, International Migration and Contemporary Cities (RU 26:834:690)	Fall	Rutgers
Research Core (12 credits)		
Qualitative Methods (RU 26.977.620)	Spring	Rutgers
Quantitative Methods (URB 6103)	Fall	RBHS
Additional research methods course		
Additional research methods course		
Electives (18 credits) Chosen in consultation with academic advisor and, eventually, dissertation advisor		
Dissertation research (12 credits)		
Total credits (51)		

Ph.D. in Computer Engineering

Degree Requirements

To graduate, students must have an approved dissertation and are expected to attain an overall GPA of at least 3.5. Students need always to get departmental approval for the courses they take for their degree requirements.

Ph.D. in Computer Engineering (students with a master's in computer engineering or equivalent)

Code	Title	Credits
Electives		
700-level courses[1]		12
Dissertation		
ECE 790 Doct Dissertation & Res [2]		
Seminar		
ECE 791	Graduate Seminar [3]	0
Total Credits		**12**

Course List

[1] No more than 6 credits may be ECE 725 or ECE 726 Independent Study. 700-level courses may be substituted by 600-level courses if the academic advisor appeals on behalf of the student to the Office of Graduate Studies and receives approval. Additionally, ECE 630, ECE 632, ECE 639, ECE 681, ECE 657, ECE 618, ECE 692, ECE 690, ECE 605 and ECE 666 can be replaced as 700-level courses because of lack of 700- level course in these tracks. Whether or not a program requires additional courses above the aforementioned minimum requirements, a Ph.D. student's dissertation committee may ask the student to take additional courses.

[2] Ph.D. students who pass the Qualifying Examination (QE) must then register for 3 credits of pre-doctoral research (ECE 792B Pre-Doctoral Research) per semester until they defend successfully the dissertation proposal. Ph.D. students who defend the dissertation proposal successfully must then register for the 1-credit dissertation course (ECE 790A Doct Dissertation & Res) each semester until they complete all degree requirements. Students may take courses simultaneously with the 790 or 792 course as per Ph.D. program guidelines or dissertation committee recommendation.

[3] Students must register six semesters for this seminar. Student must attend at least 5 seminars per semester. Part-time students may request that this requirement be waived for some semesters.

Ph.D. in Computer Engineering (students with a Baccalaureate degree in computer engineering or equivalent)

Code	Title	Credits
Electives		
600 and 700-level courses[1]		36
Dissertation		
ECE 790 Doct Dissertation & Res [2]		

Code	Title	Credits
Seminar		
ECE 791	Graduate Seminar ³	0
Total Credits		**36**

Course List

¹ Ph.D. students with a recognized Baccalaureate degree are required to take eight 600-level or 700-level 3-credit courses (24 credits) of coursework beyond the Baccalaureate degree as well as four additional 700-level 3-credit courses (12 credits), for a total of twelve 3-credit courses (36 credits). Master's project (course 700), Master's thesis (course 701), or more than two independent study courses (courses 725 and 726) cannot be used to satisfy these coursework requirements. No more than 6 credits may be ECE 725 or ECE 726 Independent Study. 700-level courses may be substituted by 600-level courses if the academic advisor appeals on behalf of the student to the Office of Graduate Studies and receives approval. Additionally, ECE 630, ECE 632, ECE 639, ECE 681, ECE 657, ECE 618, ECE 692, ECE 690, ECE 605 and ECE 666 can be replaced as 700-level courses because of lack of 700- level course in these tracks. Whether or not a program requires additional courses above the aforementioned minimum requirements, a Ph.D. student's dissertation committee may ask the student to take additional courses.

² Ph.D. students who pass the Qualifying Examination (QE) must then register for 3 credits of pre-doctoral research (ECE 792B Pre-Doctoral Research) per semester until they defend successfully the dissertation proposal. Ph.D. students who defend the dissertation proposal successfully must then register for the 1-credit dissertation course (ECE 790A Doct Dissertation & Res) each semester until they complete all degree requirements. Students may take courses simultaneously with the 790 or 792 course as per Ph.D. program guidelines or dissertation committee recommendation.

³ Students must register six semesters for this seminar. Student must attend at least 5 seminars per semester. Part-time students may request that this requirement be waived for some semesters.

Deadlines

Students who do not meet the following deadlines will be dismissed from the Ph.D. program.

- The required coursework for the Ph.D. program and the (major part of the) QE must be completed successfully by the end of the second year in the program.
- The dissertation proposal must be defended successfully either by the end of the third year in the Ph.D. program or four semesters after registering for the first time in the 792 pre-doctoral research course, whichever occurs earlier.
- The dissertation must be defended successfully by the end of the sixth year in the Ph.D. program.

Selection of Dissertation Advisor

Students must select a dissertation topic and advisor within 6 months of joining the program. Advisors are assigned based on student preferences and availability of funding. Change of advisor requires consent of the previous advisor and departmental approval. In cases where more than one advisor is directing the dissertation, the primary advisor must be on the core departmental faculty.

Qualifying Examination

Goal: ECE Department's qualifying exam needs to be a constructive component in the development of a student's research skills and along with the course work requirements to identify students qualified for research.
Exam Structure: The Ph. D. Qualifying Exam has two parts: I) GPA requirement on selected courses, and II) Research potential assessment.

Part I. GPA Course Requirements:

ECE Course Requirement: Prequalified doctoral students are required to pass four courses selected from a list of relevant doctoral courses ("core courses") with a GPA of at least 3.5 or higher.

Each research group (Communications, Signal Processing and Microwave; Computer Networking; Computer Architecture, Electronic and Photonic Devices; and Intelligent Systems) has its own list of courses. Courses are listed at the bottom of this section.

Part II. Research Potential Assessment Oral Qualifier:

The research potential assessment oral qualifying examination must be taken within the first year from the time the student starts the Ph.D. program if he/she has a MS degree. In the case of a student accepted into the BS-Ph.D. track, the exam must be taken within two years from the time the student starts the Ph.D. program. For the students accepted with a MS degree, within the first two semesters from the time the student starts the Ph.D. program the student must complete one Independent Research course in his/her research area of interest. For the Independent Research course, the student registers with a faculty member who may or may not be the student's prospective Ph.D. advisor.

The oral exam committee will be assigned by the Associate Chair for Graduate Studies of the ECE Department. It will be chaired by a faculty member from an area different from the student's area of interest. In addition to the Chair, the committee will include three faculty members in the student's area of interest. The supervisor of the independent research work or the student's prospective advisor may be part of the committee.

A student must send in an official application for taking the oral Qualifying exam to the Associate Chair for Graduate Studies, at least one month before the target date of the oral exam committee. The student is responsible to find a time such that all committee members can attend. In the application, the student should identify the research focus area for the exam and outline how the course requirements (if any) for that focus area have been met.

For the oral exam, the student will prepare a written report to the committee and to the associate chair for graduate studies at least one week before the exam date. The report should be written following the standard format of a conference paper, with 4-6 pages in double column, font size 11. The subject of the oral exam is to be chosen by the student. It is recommended that this choice be made in consultation with a faculty advisor and the ECE associate chair for graduate studies. A suitable basis for the examination may include, but is not restricted to:

• A paper/report (conference, journal, technical report, patent, and/or published or submitted)
• A conference paper submission based on research under the supervision of a faculty advisor.
• An M.S. thesis in preparation or previously completed thesis
• A final project report derived from an ECE Independent Study course.

During the exam the student will make a 30-minute oral presentation of his/her own independent research to the oral exam committee.

The oral presentation will be followed by an open-ended question and answer session that may include questions specific to the research project as well as questions generally relevant to the research area regarding fundamental knowledge underpinning the project topic. In addition, basic questions from various different areas can be asked to determine student's breadth of understanding.

Since this examination will occur in the early stages of research, and since the oral exam is not a doctoral defense, the presented paper need not lead to a Ph.D. thesis proposal. For the examination committee, evaluation of the originality and novelty of the research contribution will be secondary to an evaluation of the student's critical thinking skills. Specifically, the committee will focus on the student's ability to analyze, interpret and articulate both strengths and weaknesses of the work. Outstanding students, who have published several papers prior to starting their Ph.D. program, are encouraged to take the oral qualifying exam during the first semester of the Ph.D. program.

The committee will provide a written evaluation of the student's potential for Ph.D. research (in terms of technical ability, and oral and written communications skill) to the department. The committee members can seek input from the prospective Ph.D. advisor when making such evaluation, but the advisor is excluded from participating in formulating the written evaluation. Each member of the Ph. D. Qualifying committee votes to pass or fail the student. The written report should include the vote. The vote of 3:1 or 4:0 is needed for the student to pass the Ph.D. Qualifying Exam.

The ECE department will make the final decision of pass or fail based on the exam committee's report. The student will be allowed two chances to take the Ph.D. Qualifying Exam. The second attempt must be taken within six months from the time the student made the first qualifying exam. Failure to do so will automatically dismiss the student's qualification for further doctoral study.

The Ph. D. Qualifying Exam is offered year around. Five Areas of the Ph. D. Qualifying Exam

• Communications, Signal Processing and Microwave
• Computer Networking
• Computer Architecture
• Electronic and Photonic Devices
• Intelligent Systems

The student needs to select a minimum of 4 courses out of 6 courses (or equivalent) required by each area: Students can take additional courses as per the advisement of area. Here are the suggested courses for different areas:

Communication	Signal Processing	Microwave	Networking	Computer Architecture	Electronic & Photonic	Intelligent Systems
ECE 725	ECE 725	ECE 725	ECE 725	ECE 725	ECE 725	ECE 725
ECE 726	ECE 726	ECE 726	ECE 726	ECE 726	ECE 726	ECE 726
ECE 742	ECE 740	ECE 742	ECE 783	ECE 690	ECE 758	ECE 788
ECE 744	ECE 743	ECE 630	ECE 681	ECE 758	ECE 657	ECE 666
ECE 776	ECE 788	ECE 632	ECE 744	ECE 692	ECE 756	ECE 605
ECE 777	ECE 777	ECE 744	ECE 639	ECE 689	ECE 618	ECE 618

Formation of Dissertation Committee

A dissertation committee must be formed within three months after passing the qualifying examination. The dissertation committee must be approved by the ECE Department Graduate Affairs Committee at the time of its formation and before the presentation of the research proposal. The dissertation committee chairperson typically is the doctoral candidate's program advisor, but other faculty may be selected, provided that they are from the ECE Department. The committee consists of a minimum of five members, one of whom is external to the ECE Department or to NJIT, and at least three of whom are members of the ECE department. The dissertation advisor must be a tenure-track or tenured faculty member at NJIT. If the dissertation advisor is an ECE department faculty member, then the chair of the student's dissertation committee may be any tenure-track or tenured faculty member in the ECE Department at NJIT. If the dissertation advisor is not a member of the ECE department at NJIT, then the chair of the student's dissertation committee must be a tenured faculty member in the ECE department at NJIT. If the dissertation advisor is not an ECE department faculty member, there must be a co-advisor who is a tenure-track or tenured faculty member in the ECE department at NJIT.

Research Proposal

Doctoral candidates must prepare a written research proposal for approval by their dissertation committee. The proposal must be presented after formation of the committee but within twelve months after passing the qualifying exam. The proposal should show that facilities are available to do the work. Research is expected to investigate or develop a unique contribution to science and technology. Research may be experimental, analytical, applied, or theoretical, provided it satisfies these criteria and is approved by the dissertation committee. The research proposal would normally include title and goal of the proposed dissertation; a detailed discussion of background material, including a literature search; a summary of work accomplished to date; a statement of how the residency requirement will be met; and a proposed time table for completion of research.

Dissertation and Defense

A dissertation should demonstrate original research that contributes to knowledge in the field. The dissertation should result in scholarly publication and must be defended in a publicly-announced oral defense. A typed version of the completed dissertation should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary's office (235 ECEC) three weeks before the defense. Successful defense of the dissertation is determined by vote of the dissertation committee. All members of the committee must be present to hear the defense. In regard to format, the standard reference is the latest edition of the Estrin/Roche manual Guidelines for Scientific and Professional Theses. The Office of Graduate Studies policies on number of copies, deadlines, and submission of dissertation and abstracts are

also to be followed. Every member of the dissertation committee must sign the approval page of the final dissertation document. Students cannot be certified by the ECE department for the doctoral degree until the student publishes at least one paper in a peer-reviewed journal deemed of acceptable quality by the dissertation advisor.

Ph.D. in Electrical Engineering

Degree Requirements

To graduate, students must have an approved dissertation and are expected to attain an overall GPA of at least 3.5. Students need always to get departmental approval for the courses they take for their degree requirements.

Ph.D. in Electrical Engineering (students with a master's in electrical engineering or equivalent)

Code	Title	Credits
Electives		
700-level courses[1]		12
Dissertation		
ECE 790 Doct Dissertation & Res [2]		
Seminar		
ECE 791	Graduate Seminar [3]	0
Total Credits		12

Course List

[1] No more than 6 credits may be ECE 725 or ECE 726 Independent Study. 700-level courses may be substituted by 600-level courses if the academic advisor appeals on behalf of the student to the Office of Graduate Studies and receives approval. Additionally, ECE 630, ECE 632, ECE 639, ECE 681, ECE 657, ECE 618, ECE 692, ECE 690, ECE 605 and ECE 666 can be replaced as 700-level courses because of lack of 700- level course in these tracks. Whether or not a program requires additional courses above the aforementioned minimum requirements, a Ph.D. student's dissertation committee may ask the student to take additional courses.

[2] Ph.D. students who pass the Qualifying Examination (QE) must then register for 3 credits of pre-doctoral research (ECE 792B Pre-Doctoral Research) per semester until they defend successfully the dissertation proposal. Ph.D. students who defend the dissertation proposal successfully must then register for the 1-credit dissertation course (ECE 790A Doct Dissertation & Res) each semester until they complete all degree requirements. Students may take courses simultaneously with the 790 or 792 course as per Ph.D. program guidelines or dissertation committee recommendation.

[3] Students must register six semesters for this seminar. Student must attend at least 5 seminars per semester. Part-time students may request that this requirement be waived for some semesters.

Ph.D. in Electrical Engineering (students with a Baccalaureate degree in electrical engineering or equivalent)

Code	Title	Credits
Electives		
600 and 700-level courses[1]		36
Dissertation		
ECE 790 Doct Dissertation & Res [2]		

Code	Title	Credits
Seminar		
ECE 791	Graduate Seminar [3]	0
Total Credits		**36**

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