

PROGRAM ANNOUNCEMENT

April 2008

Institution:	New Jersey Institute of Technology
New Program Title:	Master's Program in Critical Infrastructure systems
Degree Designation:	MS in Critical Infrastructure Systems
Degree Abbreviation:	MSCI
CIP Code and Nomenclature (<i>if possible</i>):	
Campus(es) where the program will be offered:	New Jersey Institute of Technology, University Heights, Newark
Date when program will begin (month and year):	Fall 2008
List the institutions with which articulation agreements will be arranged:	School of Public Health - UMDNJ

Is licensure required of program graduates to gain employment? Yes No
(not at this time)

Will the institution seek accreditation for this program? Yes No
If yes, list the accrediting organization:

Program Announcement Narrative

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Descriptive Information

I. Objectives

This program presents an integrated end-to-end approach to the area of Critical Infrastructure Lifecycle and Emergency Management Education and Research, across multiple sectors. **Life-cycle Management** focuses on planning issues, maintainability and safety engineering, vulnerability analysis, hazard/crisis impact analysis and mitigation, infrastructure inter-dependencies, rehabilitation technologies, condition assessment, problem detection, diagnosis and process propagation, and program management. **Security and Emergency Management** includes critical infrastructure and population protection, emergency management, preparedness and response management, enabling and protective technologies, evacuation planning and information systems applications to infrastructure and homeland security.

A cooperative agreement with UMDNJ – School of Public Health will be in place with relevant courses from their preparedness and other relevant areas shown in the curriculum.

II. Need

A. Need for the Program

The challenges posed by the maintenance and upgrading of our aging inter-dependent infrastructure go beyond what any profession (engineering, management, computer Sciences); more importantly, the recognition of the management of today's and tomorrow's infrastructure as a multi-disciplinary problem, both across sectors of infrastructure inter-dependency and across functional areas needed to solve the lifecycle planning, design and (securely) operate, detect and respond. The array of technologies and systems required to participate in the infrastructure challenges ranging from the upgrading of the civil infrastructure to hardening the control systems and cyber-infrastructure, makes it difficult for traditional degrees to meet these challenges without a new breed of multi-disciplinary professional. NJIT's location in Newark, a key infrastructure hub, and an area with major infrastructure dependencies, adds to the incentive for providing an educational background and research opportunities in an area ripe with test-beds and job opportunities in this new and growing field. Also, NJIT's partnership with the City of Newark, which is experiencing strong re-development, offers opportunities for both student recruiting and research.

These graduates/professionals will be the urban infrastructure planners (city/utility regional planners, systems design engineers, development project managers) of the future, as well as the Construction Managers for large facilities (Army, Navy, Air Force, National Guard, etc.). Other

Jobs relate to DHS personnel/analysts, security management and infrastructure systems consultants, and a myriad of different job titles in the private and public sectors. The Program will also target UN, US Aid and the World bank for Infrastructure Development Specialists and Project Managers as well as high-level officials in developing countries.

B. Describe the relationship of the program to the following: institutional master plans and priorities.

The 1981 Statewide Plan for Higher Education identified NJIT as New Jersey's comprehensive technological public university. Furthermore, the Statewide Plan indicates that NJIT "has a special responsibility to provide technical services and assistance to the state and local government agencies and the industrial community by providing technical programs and undertaking research applied to New Jersey's needs." All of these are subsumed in the four-pronged mission of NJIT, namely education, research, economic development, and public service. Indeed, the proposed Critical Infrastructure Systems program is a step in this direction since the program aims to address the following:

- "Prepare students for productive careers and enhance their potential for lifelong personal and professional growth."
- Prepare students in the conduct of inter-disciplinary research.
- Serve "both its local communities and the broader society of the state and nation by conducting public policy studies, making educational opportunities widely available, and initiating community-building projects."

Also, NJIT has an interest through its Provost and Deans in this Inter-disciplinary Program with large opportunities for dual degrees with the School of Architecture (MIP), the School of Management, and the Colleges of Engineering, Sciences and Liberal Arts, and Computing Sciences.

C. List similar programs within the state and in neighboring states. How does this program compare to those currently being offered?

This Program is quite unique in terms of its goals, its target student base, and its inter-disciplinary Matrix approach to the problem of Critical Infrastructure Lifecycle/Security Systems and Management.

Rutgers' Center for Advanced Infrastructure and Transportation (CAIT) has a focus on maintenance of high volume transportation infrastructure and is aligned with the goals of US DOT. It is the goal of CAIT to be a catalyst for creating a multi-modal transportation infrastructure research and education paradigm that incorporates input from members of the Transportation community.

Polytechnic University in NY offers a MS In Civil Engineering with an Urban Systems Engineering and Management concentration.

Carnegie Mellon University's Advanced Infrastructure Systems (AIS) with a MS in AIS also bears some similarities with our program. It has a strong focus on data capture technologies, data management and analysis technologies, and decision support technologies. It aims at developing the ability to design and evaluate systems for intelligent behavior in an infrastructure-oriented domain.

The Master of Infrastructure Planning from the University of Stuttgart bears some similarities to our proposed program. However, it presents a rather structured set of pre-defined courses with more required/mandatory courses across all infrastructure areas. Our MS CIS Program offers more optional electives related to lifecycle management, security/emergency management and enabling technologies.

The strength of this proposed NJIT Program lies in its end-to-end cross-sector infrastructure systems orientation **to address both lifecycle and security systems in the management of critical infrastructure** of the future.

III. Students

Anticipated Enrollment can be around 20 in the first year from NJ Homeland Security and Infrastructure Protection Units, engineering firms, agencies and utilities. The enrollment can be ramped up to 50 based on solid marketing, and possibly 100 with extensive outreach to national and international agencies.

IV. Resources to Support the Program

A. Course Development

In anticipation of the introduction of an MS degree in Critical Infrastructure Systems, over the last two years some courses that are specifically required for training in Critical Infrastructure Systems, Performance and Risk Analysis of Infrastructure Systems (CE 671), and “Security Management of Critical Infrastructure” (CE 672), have been designed and implemented as part of our current graduate curriculum in MS-CEE. All core courses and a large number of the electives of this Program are now in place. Some course development is still envisioned to strengthen some of the key areas. For example, in the Engineered Systems sub-area, the following courses are planned for development over the next 2 years:

- CE Water/Wastewater Maintenance and Capital Improvement Management Systems
- CE Highway, Bridge and Tunnel Maintenance and Rehabilitation
- CE Managing the Design/Build/Operate Environment: BIM

Similarly, in the Emergency and Preparedness sub- area, the following course is planned for development in the next 2 years:

- CE/Tran Network Optimization and Emergency Evacuation Planning

In the Enabling Systems and Technologies, the following 2 courses are planned for development:

- Design of Protective Technologies
- Cyber Infrastructure Forensics and Security

These courses can be developed with existing resources, and the use of adjunct faculty members in some cases, as the number of enrolled student increases.

B. Faculty

The Program can be launched with total reliance on internal course development and adjuncts, and no additional new faculty.

C. Libraries and Computing Facilities

Since this program will draw upon existing courses and upon the same supplemental literature that supports them and other related NJIT programs, existing library holdings are more than adequate to support the new program. NJIT's Van Houten Library has a collection of more than 150,000 books and subscribes to more than 1,000 print periodicals and about 8,000 electronic journals. The library's home page provides access to NJNEER, the library's electronic catalog and links to a wide array of information services.

The library has an adequate number of networked microcomputers that provide access to many bibliographical databases and full-text electronics journals. Workstations/computers are available for searching the World Wide Web as well as the library's on-line catalog; access to CD-ROM based databases and a variety of on-line journal databases. VCRs for viewing videocassettes reserved for courses are also available. Journal and conference literature in engineering, science, management, architecture, and other subject areas is accessible through a variety of indexing and abstracting publications in both print and electronic format. Among the databases available on line are CompendexWeb (Engineering Index); Proquest Direct (articles on business, management and industry); Applied Science and Technology Index; and UnCover, a document delivery service that faxes articles within 48 hours.

A student user manual describing library services is available at the circulation and reference desks.

As a technological research university, NJIT has excellent computing systems, networks and software to support this program. The Newark campus' gigabit Ethernet network backbone connects more than 6,000 nodes in classrooms, laboratories, residence halls, faculty and staff offices, the library, and student organization offices. Wireless access is available in over 90% of campus buildings and locations. The network provides access to a wealth of shared information services. Some of these include high-performance computing servers providing CPU cycles for simulation and computational research, disk arrays for storage of large data sets, communication servers for electronic mail and document exchange, databases, digital journal subscriptions and a virtual "Help Desk." A virtual private network combined with Internet access, plus a large ISDN modem bank extend access to campus information resources to faculty, staff and students working at home, work, any of the university's extension sites or throughout the world. Wide-area network access through NJEDge.Net, New Jersey's Higher Education Network, and through Internet2 provides collaboration opportunities with students, faculty, and researchers, locally, regionally, nationally, and throughout the world.

D. Classrooms and Laboratories

No new classrooms would be needed for this program. The computational resources on campus, including SAS software available to students, are currently sufficient for instructional purposes. As demands on faculty for research in security modeling and consulting services grow with the program, we visualize a possible future need for a dedicated Critical Infrastructure laboratory with supporting hardware and software.

V. Curriculum

Requirements for the Program:

Admission Requirements:

- 4 year baccalaureate degree
Students applying for admission to this program will usually have a baccalaureate degree in Engineering, Statistics, Mathematics, Sciences, or Computer Science. Applicants with other baccalaureate degrees will also be considered and may be subject to a suitable bridge program.
- GPA of at least 3.0 on a 4.0 scale or equivalent in combined core (math, sciences, engineering) subjects
- At least 12 credits in mathematics, including calculus
- at least one upper division course in statistics

Bridge Program: Students who do not satisfy the credit requirement in mathematics will be required to take a suitable bridge program of appropriate mathematics/statistics courses. Such courses do not count towards the graduate degree.

Degree Requirements:

A minimum of 30 credits is required for the degree. Bridge courses, if any, will not count toward degree credits. The graduate curriculum consists of four core courses (12 credits) in background Performance and Risk analysis of infrastructure systems, Security Management, Management Science and Elements of Infrastructure Planning, as described in the curriculum below. The remaining 18 credits are elective courses of which 12 credits should be from the concentration area. Electives are chosen in consultation with the Program Director and Academic Advisors from 2 key concentration areas (**Critical Infrastructure Life-Cycle Management (CILC)** and **Critical Infrastructure Security and Emergency Management (CISE)**) which consist of 6 sub-areas:

CILC: - Planning and Facilities Management

- Engineered Systems
- Public Health Systems (Joint UMDNJ)
- Program/Impact Management

CISE: - Emergency and Preparedness (Joint UMDNJ)

- Enabling Systems and Technologies

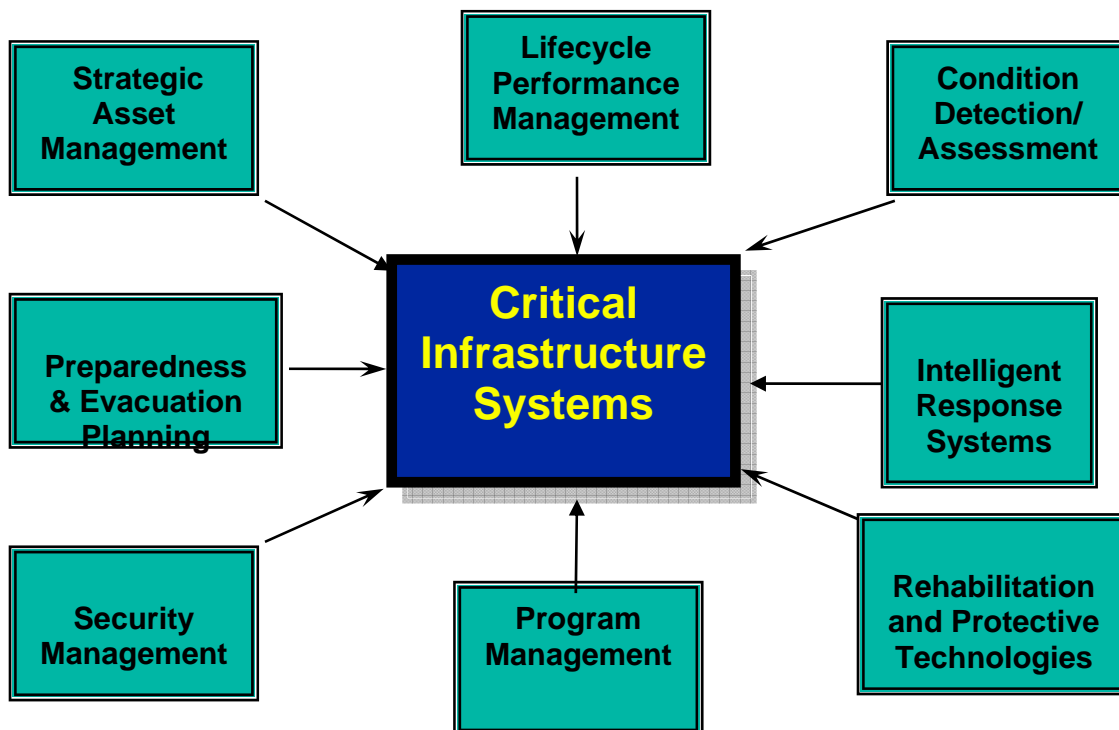
In order to qualify for a concentration, a student should take 12 credits from a master list of courses. However, if these courses are not offered, equivalent subjects may be assigned by Academic Advisor. A master's project or thesis is an elective course which counts towards the minimum 30 credits. Also, if a core course was already taken at the graduate level with a 3.0 or above (B and above), the Academic Advisor can substitute such core course by another course on the Electives list.

Curriculum:

Suggested Curriculum for MS-CI

The Program cover all engineered public and private sector infrastructure (civil and engineered systems including buildings/urban development, transportation (highways/tunnels/bridges/airports), power plants/systems, environmental (water/wastewater/ecological), telecommunications, computer networks and Cyber Infrastructure), and Public Health Infrastructure management.

Integrating Infrastructure Performance and Security Management



Core Courses (12 credits)

CE 671	Performance and Risk Analysis of Infrastructure Systems
CE 672	Security Management of Critical Infrastructure
EM 602	Management Science
ARCH 675	Elements of Infrastructure Planning

The remaining 18 Credits of Electives can be taken from 2 Concentrations: the **Critical Infrastructure Life-Cycle Management (CILC) Elective Area** and the **Critical Infrastructure Security and Emergency Management (CISE) Elective Area**. An area of concentration is earned when at least 12 credits are taken from that Elective area of Concentration and its component sub-areas:

**MS in Critical Infrastructure Systems Elective Areas
(TBD)- To Be Developed**

<u>Critical Infrastructure Life-Cycle Management Elective Area</u>	<u>Critical Infrastructure Security and Emergency Management Elective Area</u>
<p>Planning and Facilities Management ARCH 673 Infrastructure Planning in Practice CE 602 Geographic Information Systems IE 653 Facilities Management IE 606 Maintainability Engineering CE 506 – Remote Sensing of Environment CE 601 - Advanced Remote Sensing CE 615 Infrastructure & Facilities Remediation</p> <p>Engineered Systems (TBD) 2007/08 Water/Wastewater Maintenance and Capital Improvement Systems (TBD) 2007/08 Highway, Bridge and Tunnel Maintenance and Rehabilitation Tran 705 Mass Transportation Systems ECE 610 Power Systems Analysis CE650 Urban Systems Engineering ECE 637 Introduction to Internet Engineering ECE 642 Communication Systems ECE 637 Computer Network Design and Analysis (TBD) Managing the Design/Build/Operate Environment: BIM</p> <p>Public Health Systems (Joint UMDNJ) PHCO 0502 Principles and Methods of Epidemiology PHCO 0503 Introduction to Environmental Health</p> <p>Program/Impact Management EM 636 Project Management EM 637 Project Control CE610 Construction Management CE 616 Construction Cost Estimating CE611 Project Planning and Control IIE 651 Industrial Simulation IE 605 Engineering Reliability IE 614 Safety Engineering Methods EnE 671 Environmental Impact Analysis EnE 610 Hazardous Site Operations HRM 601 Organizational Behavior CE 700/701 – Master’s Project or Thesis</p>	<p>Emergency and Preparedness (Joint UMDNJ) (TBD) 2007/08 CE/Tran Network Emergency Evacuation Planning ECE 638 Network Management and Security MGT 612 Principles of Emergency Management ENOH xxxx – Public Health Preparedness I: Agents of Mass Injury or Destruction ENOH 0696 Public Health Preparedness II: Emergency Management and Response HEBS 0679 Health Communications/Risk Communications IS 613 Design of Emergency Management Information Systems IS 615 Improvisation in Emergency Management IS 614 Command and Control Systems</p> <p>Enabling Systems and Technologies (TBD) Design of Protective Technologies (TBD) Cyber Infrastructure Forensics and Security MIS 648 DSS for Managers Tran 752 Traffic Control Tran 615 Traffic Studies and Capacity EM 771 Operations Cost and Management Control MGT635 Data Mining & Analysis MGT 650 Knowledge Management CS 631/ Database Mgt Systems CS 632 Advanced DB Mgt Design CS782 Pattern Recognition and Applications IE 706 Queueing Approach to Performance Analysis IE 621 Systems Analysis and Simulation CE 700/701 – Master’s Project or Thesis</p>