

**CE 671-102: Critical Infrastructure I
Performance and Risk Analysis of
Infrastructure Systems**

Class Hours

Wed 6:00PM-8:50 PM TIER 114 (First Day of Class Jan 22, 2020)

Office Hours (Colton 274)

Wed 4:30 PM- 6:00 PM and Thu 4:00 PM-5:30 PM or by e-mail or appointment
at (973) 642-4198 or karaa@njit.edu

Prerequisites: (MATH 225 -Survey of Prob. & Stats. Or equivalent)

REQUIRED TEXT

Martland, Carl, "Toward More Sustainable Infrastructure", 2012, John Wiley & Sons, Incorporated, ISBN:9780470448762. This textbook is referred to in syllabus as TMSI.

OTHER REFERENCES

Hudson, W. Ronald, Hass, R. and Uddin, W., *Infrastructure Management, Design, Construction, Maintenance, Rehabilitation, Renovation*, McGraw Hill, 1997, out of print, ISBN 0-07-030895-0. This textbook is referred to as IM. Chapters from IM are listed as further reading background, and are optional.

Grigg, Neil S., *Water, Wastewater and Stormwater Infrastructure Management*, Lewis Publishers, CRC Press, www.crcpress.com, 2003, ISBN number 1-56670-573-8.

Other files are assigned electronically as supplemental readings and will be e-mailed to class participants. These are denoted in course outline as Efiles.

COURSE DESCRIPTION:

This course presents a Comprehensive systems approach to infrastructure asset management across areas of public and private infrastructure. Topics include the framework of integrated asset management illustrated in transportation, water and wastewater systems, the economic evaluation of infrastructure options, using life cycle cost analysis (LCCA) and cost-benefit analysis (CBA). The elements of performance measurement and modeling, including condition assessment and information management, failure and impact analysis are covered. Decision and risk analysis are covered to enable students to develop a holistic economic, performance and risk analysis approach to infrastructure management illustrated in a term project. Infrastructure financing options and private-public partnerships are presented and discussed

LEARNING OUTCOMES

This course covers the analytical issues related to the modern approach of infrastructure management. Using the methodologies covered, you should be able to:

- Analyze potential infrastructure projects or alternative configurations.
- Perform a professional comparative economic/financial analysis of infrastructure projects
- Understand and apply the concepts of life-cycle analysis and their particular relevance to infrastructure maintenance, rehabilitation and reconstruction.
- Understand the components of modern Asset Management, condition assessment and performance measurement.
- Understand the concepts and high-level architecture of IT-based maintenance management systems, and the multi-step managerial approach to maintenance management.
- Develop an understanding of the range of techniques for project evaluation, prioritization and optimization of work programs
- Understand the methodology of risk analysis and its application to infrastructure problems.
- Identify the components and process flow of a comprehensive Infrastructure Assessment study applied to a wastewater network.

COURSE OUTLINE (Subject to updating throughout semester)

Week	Date	Textbook/Reading	Assignment	Topics
1	22-Jan	TMSI Ch. 1, Efiles, National Council on Public Works Improvement	Assignment 1 (2 week): Case on Infrastructure Development Strategy, Infrastructure Links to Economy - Part 1	Introduction to Infrastructure Mgmt, Asset Management, Project Evaluation, Infrastructure Impact Hierarchy in Development
2	29-Jan	Efiles, TMSI Ch. 4, Role of Infrastructure on Economic Recovery, Growth and Trade		Infrastructure Links to the Economy - Part 2; Public Perspective: Economic, Environmental & Social Concerns in Project Evaluation
3	5-Feb	TMSI Ch.7, Efiles	Assignment 1 (Part 2)- Infrastructure Impact on Economy-ARRA, Economic, Trade Roles	Annuity Analysis; Future and Present Value Analysis; Financial Analysis of Projects
4	12-Feb	Efiles (On-line)	Assignment 2 (2 week): Financial Analysis/Project Evaluation	Capital Budgeting; Evaluation Techniques, Cost-Benefit Analysis (CBA) Primer; LCCA
5	19-Feb	EFiles, BCA, LCCA Primers, DOT examples/manuals,	Assignment 3: Effect of taxes on Project ROI,	Benefit-Cost Analysis (BCA) and Life Cycle Cost Analysis Methods;
6	26-Feb	Efile, TMSI Ch. 9 and 10,	Assignments 4 and 5 (2 week): Project and Capital Budgeting Financial Models, CBA, LCCA,	NPV and IRR Methods with Depreciation and Taxation Effects; Taxation and Depreciation; Capital Rationing, Project Prioritization

7	4-Mar	TMSI Ch. 3 ,	Assignment 6: Chapter 3, Consumer Surplus, Elasticity of Demand Assignment, Consumer and Producer Surplus	Economic Analysis of Infrastructure Projects (Pricing, consumer Surplus, economies of scale, etc.)
8	11-Mar	Exam Review	Reviews of Solutions to Assignments	Assignments 3 to 6 Answers
	13-22 Mar	SPRING RECESS		
9	25-Mar	Mid-Term Exam	Abstract for Term project Due	
10	1-Apr	Transportation Asset Management E-Files	Readings on Asset management; Transportation Project Categories	Transportation Asset Management; New Guide; Advances State of the Practice
10	8-Apr	TMSI Ch. 11.1 and 11.2, Efiles TMSI, Ch. 2, System Performance; Efile, "Performance of Water Distribution Networks", Karaa and Marks	Assignment 7: Infrastructure Master Planning Analysis Case Design of Performance Model;	Infrastructure Planning, Maintenance Mgmt. Systems/ Condition Assessment Performance Models, Measurement, Deterioration Curves
11	15-Apr	Papers (wastewater system IM, optimal replacement time concepts, E-Files)		Wastewater Infrastructure Management and Optimal replacement Time Concepts; Integrated IMS Case Infiltration and Inflow, Program Prioritization
12	22- Apr	Papers (water distribution budgeting models, Sewer I&I control, E-Files)		Optimization Models for Infrastructure Portfolio Management and Advanced Computerized Condition Assessment Techniques
13	29-Apr	Team Final Presentations		Presentation Term Papers
14	6-May	Term Project Report		Final Report Submitted at Portal
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Final Exam date (May 8 to 14) may be used for continuation of class presentations if needed.

NJIT Honor Code: the NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

GRADING POLICY:

In order to cover a broad cross-section of subjects, Students will be asked to write a paper and present their key points during a 10-15 minute presentation. This term paper/presentation will account for 35% of the overall grade.

The overall term grade will be based on the following elements:

Paper/Presentation: 35% (Term Paper Expectations and Grading model will be provided in detailed document)

Homework and Class Participation: 35%

Mid-Term: 30%

Note: March 20 Class does not meet as it is Spring recess Week.

(Note: THE WEIGHTS of GRADES may be adjusted).

Spring 2020 Academic Calendar

January	20	Monday	Martin Luther King, Jr. Day
January	21	Tuesday	First Day of Classes
January	25	Saturday	Saturday Classes Begin
January	31	Friday	Last Day to Add/Drop a Class
January	31	Friday	Last Day for 100% Refund, Full or Partial Withdrawal
February	1	Saturday	W Grades Posted for Course Withdrawals
February	3	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	17	Monday	Last Day for 50% Refund, Full Withdrawal
March	9	Monday	Last Day for 25% Refund, Full Withdrawal
March	15	Sunday	Spring Recess Begins - No Classes Scheduled - University Open
March	22	Sunday	Spring Recess Ends
April	6	Monday	Last Day to Withdraw
April	10	Friday	Good Friday - No Classes Scheduled - University Closed
May	5	Tuesday	Friday Classes Meet
May	5	Tuesday	Last Day of Classes

May	6	Wednesday	Reading Day 1
May	7	Thursday	Reading Day 2
May	8	Friday	Final Exams Begin
May	14	Thursday	Final Exams End
May	16	Saturday	Final Grades Due
May	19	Tuesday	Commencement - Undergraduate Ceremonies at Prudential (Tentative)
May	21	Thursday	Commencement - Graduate Ceremonies at WEC (Tentative)