

Professor Frank Golon Ph.D., P.E.
Spring, 2018

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

Class Hours

Thu 6:00PM-9:05 PM CULM 111 (First Day of Class Jan 18, 2017)

Office Hours (Colton Dept)
by e-mail or appointment
at (973) 491-6900 or frank.l.golon@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 and modification throughout the semester)

Week	Date	Textbook/Reading	Assignment	Topics
1	18-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 - Example projects
2	25-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	1-Feb	TMSI Ch.7, Efiles Review Engg. Econ. PennAve Study	Assignment 2 (2 week): Financial Analysis/Project Evaluation	Annuity Analysis; Future and Present Value Analysis; Financial Analysis of Projects
4	8-Feb	Efiles (On-line)		Capital Budgeting; Evaluation Techniques, Cost-Benefit Analysis (CBA) Primer; LCCA
5	15-Feb	EFiles, BCA, LCCA Primers, NJDEP Dam Safety & DOT examples/manuals,	Assignment 3 (2 week): CBA, LCCA, Project and Capital Budgeting Financial Models	Benefit-Cost Analysis (BCA) and Life Cycle Cost Analysis Methods; Lake Cushtunk Dam Example
6	22-Feb	Efile, TMSI Ch. 9 and 10,	NY Ave Case study	NPV and IRR Methods with Deprec. & Tax Effects; Taxation and Depreciation; Capital Rationing, Project Prioritization

7	1-Mar	TMSI Ch. 3 ,	Assignment 4: Chptr 3, Consumer Surplus, Elasticity of Demand Assignment, Consumer and Producer Surplus	Economic Analysis of Infrastructure Projects (Pricing, consumer Surplus, economies of scale, etc.)
8	8-Mar	Transportation/Transit Asset Management E-Files	NJ Transit Tunnel project	Transportation/Transit Asset Management; New Guide; Advances State of the Practice
9	15-Mar	No Class	Spring Break	
10	22-Mar	Mid-Term Exam	Abstract for Term project Due	
11	29-Mar	TMSI Ch. 11.1 and 11.2, Efiles TMSI, Ch. 2, System Performance; Efile, Newark Water System example	Assignment 5: Infrastructure Master Planning Analysis Case Design of Performance Model;	Infrastructure Planning, Maintenance Mgmt. Systems/ Condition Assessment Performance Models, Measurement, Deterioration Curves
12	5-Apr	TMSI Ch. 11.3, 11.4, Efiles Paper Handouts, DA E-File	Decision and Risk Analysis Modeling Assignment 6 (2 weeks)	Dealing with Uncertainty, Infrastructure Decision/Risk Analysis, Project Teams Integration Planning Meeting
13	12- Apr	E-Files, TMSI Ch. 13, Handout on Bayesian Methods, and Value of Information Term Project Final Planning	Brainerd Lake Dam & Cushetunk Dam	Decision and Risk Analysis Modeling, Bayesian Updating (ctd.)
14	19-Apr	Papers (wastewater system IM, optimal replacement time concepts, E-Files)	Assignment 7: CBA under Uncertainty and Extreme Event Planning Passaic Valley Treatment Plant	Wastewater Infrastructure Management and Optimal replacement Time Concepts; Integrated IMS Case Infiltration and Inflow, Program Prioritization
15	26-Apr	Papers (water distribution budgeting models, Sewer I&I control, E-Files)		Optimization Models for Infrastructure Portfolio Management and Advanced Computerized Condition Assessment Techniques
16	3-May	Team Final Presentations		Presentation Term Papers

Final Exam date (May 4 to 10) 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 15 Class does not meet as it is Spring recess Week.

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

Spring 2018 Academic Calendar

January	15	Monday	Martin Luther King, Jr. Day
January	16	Tuesday	First Day of Classes
January	20	Saturday	Saturday Classes Begin
January	22	Monday	Last Day to Add/Drop Classes
January	22	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	23	Tuesday	W Grades Posted for Course Withdrawals
January	29	Monday	Last Day for 90% Refund of Tuition (no refund for fees), Full or Partial Withdrawal - no refund for partial withdrawal after this date
February	12	Monday	Last Day for 50% Refund of Tuition (no refund for fees), Full Withdrawal
March	5	Monday	Last Day for 25% Refund of Tuition (no refund for fees), Full Withdrawal
March	11	Sunday	Spring Recess Begins - No Classes Scheduled - University Open
March	18	Sunday	Spring Recess Ends
March	30	Friday	Good Friday - No Classes Scheduled - University Closed
April	2	Monday	Last Day to Withdraw
May	1	Tuesday	Friday Classes Meet
May	1	Tuesday	Last Day of Classes
May	2	Wednesday	Reading Day

May	3	Thursday	Reading Day
May	4	Friday	Final Exams Begin
May	10	Thursday	Final Exams End
May	12	Saturday	Final Grades Due
May	15	Tuesday	Commencement (Tentative) Prudential Center - Ceremony for Undergraduate, Doctoral and Honorary Degree Candidates.
