

# ENCE489G COURSE SYLLABUS, SUMMER 2022 SUSTAINABILITY & INFRASTRUCTURE

2020 EA program - Greece



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# INSTRUCTION

University of Maryland, Department of Civil and Environmental Engineering.

- Dr. Dimitrios Goulias, Associate Professor (Program Director).
- GTA (TBD)

*Guest Instructors (tentative) University of the Aegean, Department of Shipping Trade & Transport* 

• Dr. Amalia Polydoropoulou, Professor.

National Technical University of Athens (NTUA), Department of Civil Engineering

• Dr. Andreas Loizos, Professor.

National Chamber of Engineers & Architects (TEE/TMEDE)

# COURSE DESCRIPTION

With the rapid world's population growth and the transition from rural to urban living, it is predicted that by 2050 nearly 70 percent of the world's population will be living in urban areas. Large cities represent only two percent of the world's surface area, yet are the economic drivers of the world's economy accounting for over 80 percent of the world's gross domestic product (GDP). With these staggering statistics the concepts and principles of "Sustainable and Resilient Infrastructure" are vital for the survival of urban settlements and the development of healthy living conditions, along with economic prosperity. Thus, the concepts of "Sustainability," "Livability" and "Resilience" are in the forefront of planners, designers, engineers, environmentalist, citizens and users for achieving a functional, cost effective, resilient and healthy city for an improved urban experience. "Sustainability" and "Resilience" include among other:

• Infrastructure Components: Smart Sustainable & Resilient Cities & Large Scale Systems (neighborhoods, Olympic infrastructure, other); Green Infrastructure (green buildings, canals ports, and other components); Sustainable Transportation (green roads, bridges, other); Energy Systems and Climate Conservation Actions; Recycling and Waste Reduction; Monitoring Systems and Sensors; other.

Athens represents a challenging city due to the high concentration of Greek population (more than 40%) and government services, social challenges due to the significant migration, and the current economic challenges. Thus, the implementation of sustainability and resilience principles in the further development of infrastructure components is critical. The City of Athens has been proactive in addressing sustainability, resilience and climate action plans, either for a *large scale system approach* (i.e., large portions of the city and neighborhoods, large infrastructure components, such as the 2004 Athens Olympics infrastructure network and highway roadway network), combined with *project level specific* interventions, such as the Niarxos Sustainable and Resilient Complex, the Benizelos Athens International Airport, the Rio-Antirio bridge, Korinthos Canal, and other examples. The specific history and cultural heritage of the city provides unique challenges and complexity in such efforts. The various Athens city action plans address many of the 17 UN Sustainability Development Goals.

# LEARNING OBJECTIVES

By participating in this program and through the wide variety of (i) learning activities, (ii) technical and (iii) cultural site visits and (iv) field excursions, students will explore, witness and experience firsthand the innovative sustainable and resilient strategies implemented in Athens and the surrounding areas, and including:

- *Explore* Athens city action plans and case studies addressing many of the 17 UN Sustainability Development Goals;
- *Analyze "large scale system"* strategies " (i.e., large portions of the city and neighborhoods, large infrastructure components, such as the 2004 Athens Olympics infrastructure network and highway roadway network);
- *Examine "project level"* specific interventions, such as the Niarxos Sustainable and Resilient Building eco-park Complex, the Venizelos Athens International Airport, the Rio-Antirio resilient bridge, the Korinthos Canal, other;
- *Learn & apply* life cycle analysis, LCA, methods and sustainability metric ratings considering environmental implications, energy systems and energy conservation principles, recycling and waste reduction practices, mobility and greenhouse gas reduction emissions, in conjunction with economic and social implications.

Following such direct "hands-on" and "on the go" learning experiences students will develop their own sustainable solutions for specific projects pertinent to such city initiatives.

# ACADEMICS

Tech Elective, three (3) credit UMD course:

• ENCE489G Special Topics in Civil Engineering: Sustainability & Infrastructure

The credit you earn during this program will count as resident credit.

This course is approved for the Sustainability Minor and may double count for major tech elective\* (check with your department), and triple count for "Internship-and Practicum. ENCE489G is approved for the following:

- Sustainability Minor: Approved Tech Elective
- ENCE: Approved "in major" Tech Elective
- Engineering Majors: Tech Elective out of major;\*;
- Other Majors: Tech Elective out of major;\*\*
- \* ENMA students contact academic advisor for approval.

\*\* contact academic advisor to determine how this course applies to your major.

# COURSE PREREQUISITES & ELIGIBILITY

Course Prerequisite: MATH 140 or ENST 140 or ENSP 101 or equivalent\*,\*\*

- \* Contact program director for any prerequisite requirements info
- \*\* If interested in this program but do not meet eligibility requirements, reach out to program director

*Eligibility:* Open to all majors since sustainability and resilience are multi-disciplinary topics. Past participants includes students from: AGNR, ARCH, ARHU, BCHM, BIOE, BMGT, BSOS, CHEM, CMSC, ECMA, ECME, ECON, ENCE, ENEE, ENMA, ENME, ENMP, ENSP, ENST, GVPT, HLTH, KNES, LARC, LTSC, PLCY, other.

UMD and Non-UMD freshman, sophomores, juniors, seniors, and graduate students are eligible to apply.

# LEARNING OUTCOMES

By the end of the course, students should have attained competency (ABET) in the following areas:

- participatory decision making within a team;
- creating design alternatives based on community needs assessment, and cultural identity;
- creating and analyzing multiple design alternatives;
- determining appropriate techniques and methods to be used in solving societal needs mingled with engineering and environmental principles;
- determining metrics for design projects.

## COURSE STRUCTURE & ASSIGNMENTS

#### COURSE TOPICS

Sustainability, Livability, Resilience **Definitions & Components** UN 17 Sustainability Development Goals Sustainability Requirements & Infrastructure. "100 Resilient & Sustainable Cities" Plan "Integrated Climate Action Plan C40" "Rethink Athens" Sustainability Plan Green Sustainable & Resilient Infrastructure Components OAKA Olympic Complex Niarxos Foundation Complex Rio Antirio Bridge Korinthos Canal Large Scale Sustainability Sustainability Elements & Components Neighborhood LEED Rating Sustainability & Infrastructure Green Roads Components Sustainability Metrics & Rating(s) Steps of Sustainability Analysis for Green Roadways **Condition Assessment Design Principles & Methods Rehabilitation Methods** In-situ Recycling Principles & Methods (condition, materials and techniques) Principles and Design of Permeable vs Impermeable Surfaces Ex-situ Recycled Materials and Alternative "Green" Materials Principles of Life Cycle Analysis, LCA, Assessment & Tools Life Cycle Cost Analysis, LCA/LCCA for Conventional & Sustainable Alternatives Environmental Assessment Analysis: Emissions, Hazardous Waste, Energy, Water, Global Warming Potential, other. Life Cycle Environmental Analysis and Assessment for Conventional & Sustainable Alternatives Alternative Rating Method(s) Social Implications & Stakeholders

#### **DESIGN PROJECTS & CASE STUDIES**

Following such direct "hands-on" and "on the go" learning experiences students will develop their own sustainable solutions for specific projects pertinent to such city initiatives. Athens is a member of the "100 Resilient & Sustainable Cities" and the Integrated Climate Action Plan C40 (40% greenhouse gas emissions reduction by 2030) initiative of cities around the world. Furthermore a major European competition initiative was undertaken to convert Athens to a Sustainable and Resilient City, "Rethink Athens." Thus students will be exposed into these plans and will develop their sustainable design projects in locations pertinent to such initiatives.



Project Site Location & Pertinent Information: Rethink Athens Project & Plateia Klafthmonos

Pertinent References & Action Plans:

- Rethink Athens: European Architectural Competition: Resilience & Sustainability
   <u>http://www.rethinkathenscompetition.org/competition.php#Proposal2</u>
   OKRA Project Information: Rethink Athens- Transformation of Athens New City Center
   <u>https://www.archdaily.com/338001/re-think-athens-winning-proposal-okra/</u>
   Tech Report
   <u>http://www.rethinkathenscompetition.org/uploads/proposal\_entries/pdf\_results\_2/AB30273512/Rethink%20</u>
   <u>Athens2-AB30273512-11.pdf</u>
- 3. Athens' Integrated Climate Action Plan C40 (40% greenhouse gas emissions reduction by 2030) <u>http://www.c40.org/cities/athens/case\_studies</u> <u>http://www.c40.org/case\_studies/athens-plans-for-a-greener-and-cooler-city</u>

# Case Studies, Technical & Cultural Site Visits & Events

- Urban Walk (includes broader area of downtown Athens & several of the sites below)
- Syntagma Square & Metro Station/Museum- Sustainability since the ages of time\*
- National Gardens, Zappion & Panathenaic Stadium 1896)\*
- Hadrian's Arch & Temple of Olympian Zeus, New Acropolis Museum\*
- Acropolis, Parthenon, Erechtheion, Temple of Athena Nike
- Odeon of Herodes Atticus
- Ancient Agora, Temple of Hephaestus, Stoa of Attalos
- Roman Agora, Hadrian's Library & Tower of the Winds
- Thisseion District, Plaka, Monastiraki & Byzantine Monastery\*
- The Academy of Athens (Greece's National Academy)\*
- Mount Likavitos (Lecabettus);\*

- Stavros Niarchos Foundation Cultural Center (Sustainability)\*
- Athens Metro Piraeus Construction Site\*
- O.A.K.A. Olympic Athletic Center of Athens 'Spiros Louis' \*
- Field Trip(s):
  - Korinthos Canal\*, Rio Antirio Bridge.\*
  - 3 Island Cruise: Hydra, Poros, Aegina

### \* Technical/Sustainability & Resilience visits



# Niarchos Foundation Cultural Center Sustainability Components

# COURSE LOGISTICS

## Copyright Notice

All course materials are copyrighted. Course materials that exist in a tangible medium, such as written or recorded lectures, PowerPoint presentations, handouts and tests, are copyright protected. Students may not copy and distribute such materials.

IMPORTANT NOTE: This syllabus, along with course assignments and due dates, are subject to change. ELMS announcements will be sent out to the students in case a change is made. It is the student's responsibility to check ELMS for corrections or updates to the syllabus.

## Required Technology & Canvas Submissions

Students need access to a laptop computer, notepad, or other technology to access the course website and to submit assignments in Canvas. Internet access will be provided in the accommodations. Internet access may or may not be available in the classroom. Students are encouraged to download materials prior to the class in which they are needed.

## Course Location

Students will be lodged in a centrally located hotel in Athens and will be using public transportation for technical and cultural site visits. Classroom space will be available at the hotel or provider's lecture rooms for the workshops, guest lectures, and design projects. Field/ site visits outside the city limits will be via public transportation (train/bus) and/or bus rentals.

## COURSE ASSESSMENT

#### GRADING

Assignments, Participation & Class Engagement	Individual	15%
Design Project & Presentation	Group	70%
Journal(s) & Reflection Summary	Individual	15%

Grades are assigned on a relative scale ("curved') depending on the overall performance of the class through the course. An "Example only" course grade scale is shown next based on past program's performance:  $A+ (\geq 95\%)$ ; A (92-94.9%); A- (90-91.9%); B+ (88-89.9%); B (86-87.9%); B- (84-85.9%); C- (82-83.9%); C+ (80-81.9%); DC (78-79.9%); C- (76-77.9%); D ( $\leq 75.9\%$ ), etc.

### Participation & Class Engagement (15%)

This component will assess the interest, participation and interaction of each student in the different phases of this study abroad course (lectures, project design of case studies, site visits).

Throughout the program, the faculty will assess through one to one interaction, assignments and discussions the following: student knowledge of the principles of developing green infrastructure design alternatives; their ability to recognize the complex and multi-disciplinary analysis required for such projects; their knowledge and ability to identify the set of qualitative and quantitative indicators for the design of "green infrastructure." Participants will be asked to select one of the technical /cultural site visits included in the program, prepare explanatory material and present their findings and explanation to the rest of the team during the actual visit.

### Design Project Report & Presentation (75%)

Each student and team will be assessed based on the level of performance in regards to the following list of outcomes:

- participatory decision making within a team;
- ability to create and administer design alternatives based on community needs assessment, and cultural identity;
- ability to create and analyze multiple design alternatives;
- ability to determine appropriate techniques and methods to be used in solving societal needs mingled with engineering and environmental principles;
- ability to define evaluation metrics for the design project.

#### Journal(s) & Reflection Summary (10%)

At the conclusion of the program a "Reflection" summary will be prepared from each student which will highlight:

- cultural immersion experience pinpointing both social & professional differences between US & GR;
- journal details and impressions from a technical /cultural site visit of choice.

#### Participation.

The students will be working in teams to conduct their design projects. Students are expected to: i) attend all of the lecture and site visit sessions associated with this course; ii) actively participate in the design project developed by each team.

#### Academic Integrity

Students will be reminded of the academic integrity expectations and the Honor Code.

#### TENTATIVE COURSE SCHEDULE

#### Program Dates:

- UMCP Workshops: May 9 to 13, 2022 Workshops will cover (see "course topics"): definitions and principles of sustainability, livability and resilience; LCA analysis; fundamentals of sustainability analysis in terms of economics and environmental impacts; sustainability metrics; and, training on professional sustainability tools

-Pre-Departure Meeting: TBD (May)

#### Travel Dates:

-May 19 (Thursday): US Departure

-May 20 (Friday): Arrival in Athens, Airport transfer to Hotel Registration.

On-site orientation & site visits, welcome dinner. Site Visit.

-May 21 (Sunday):

Program Overview, Logistics Sustainability & Resiliency Plans for City of Athens, Design Projects

-May 22 (Sunday):

Urban Walk & Athens Site Visits.

Workshops

Sustainability Design Projects

-May 23 (Monday): Workshop Sustainability & Infrastructure

Sustainability Design Projects Site Visit, Logistics & Analysis

Site Visit Niarchos Center Sustainability Infrastructure Complex

-May 24 (Tuesday): Workshop/Guest Speakers Sustainability & Infrastructure Sustainability Design Projects Logistics & Analysis

Site Visit Athens Metro Construction

-May 25 (Wednesday): Field Trip: Korinthos Canal, Rio Antirrio Bridge, City of Nafplio

-May 26 (Thursday): Site Visit 2004 Athens Olympic Infrastructure

Workshops

Sustainability Design Projects

-May 27 (Friday): Presentation of Design Projects, Course Assessment Technical Site Visits

-May 28 (Saturday): Field trip Greek Islands Cruise: Aigina, Poros, Hydra

- -May 29 (Sunday): Reflection Summary & Site Visits Assignments
- -May 30 (Monday): Airport Transfer & Return to the US