[CEE 6536/CEE 4803E-ZNCM*]

Rehabilitation of Existing Structures, 3 Credits

* ZNCM: No-cost: $0 required costs,

The No-cost designator is for use with courses that exclusively use course materials that are free of charge to students. These materials may include open educational resources (OER), institutionally licensed campus library materials that all students enrolled in the course have access to use, and other materials that require no additional cost to students.

Open educational resources (OER) are high-quality teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license, such as a Creative Commons license, that permits their free use and repurposing by others, and may include other resources that are legally available and free of cost to students.

OER include, but are not limited to: full courses, course materials, modules, textbooks, faculty-created content, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge.

Tuesday and Thursday, 1:30 am – 2:45 am

Location: Howey (Physics)-L5

Instructor Information

Instructor	Email	Office Hours & Location
Professor Abdul-Hamid Zureick	azureick@ce.gatech.edu	Via email and/or BlueJeans by appointment
Teaching Assistant(s)	**Email**	**Office Hours & Location**
None	-	-

General Information

Description

Principles of condition assessment, repair, and strengthening of bridge, building, and other structures using fiber-reinforced polymer composites and/or stainless-steel materials. Specific topics include

I. Introduction to Recent Material Fabrication and Construction Technologies
Externally Bonded Fiber-Reinforced Polymer and Stainless-Steel Composites
Historical Development
Case studies
Fabrication Technologies
Condition Assessment of Structures
Material Properties
Analysis and Test Methods
Material and System Qualification and Acceptance Procedures
Inspection, Maintenance, and Repair Techniques
US and International Design Guidelines and Specifications

II. Strengthening of Structural Members

Members under flexure
Members under shear & torsion
Members under Axial forces
Members under combined flexure and axial forces

III Strengthening of reinforced concrete bridge peer caps and deep beams with externally bonded stainless steel or with carbon fiber polymeric reinforcement

IV Various topics for strengthening concrete, steel, and timber structures.

Pre- &/or Co-Requisites

Students are expected to have knowledge in engineering mechanics and material behavior as well as in theory and design of reinforced concrete, steel, and timber structures.

Course Goals and Learning Outcomes

Upon successful completion of this course, students should develop a clear understanding of the:

1) current state-of-the-art knowledge involving those fundamental principles, theory, assumptions, limitations, and investigative procedures that are essential for the understanding of the behavior and design of fiber-reinforced composites and stainless steel materials used in the rehabilitation of structures.

2) underlying basis for, and the details of, relevant provisions of the ***AASHTO Guide Specifications for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements***.

Course Requirements & Grading Distribution

Homework Assignments.....	10%
Midterm Test (March 11, 2021).....	30%
Project.....	30%
Final Exam.....	30%

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:
A (90-100%), B (80-89%), C (70-79%), D (60-69%), F (0-59%)

Course Materials

1) Zureick, Abdul-Hamid; Ellingwood, B. R.; Nowak, Andrzej ; Mertz, Dennis, R.; Triantafillou, Thanasis C.(2010) *Guide Specifications for the Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements, NCHRP Report 655.* *(http://www.trb.org/Publications/Blurbs/163871.aspx)*

2) ASCE-2010-Pre-Standard for Load & Resistance Factor Design (LRFD) of Pultruded Fiber Reinforced Polymer (FRP) Structures

3) Zureick, Abdul-Hamid (2002). Design of Polymer Composite Structures, Class Notes, Georgia Institute of Technology.

4) ASTM D7290-Standard Practice for Evaluating Material Property Characteristic Values for Polymeric Composites for Civil Engineering Structural Applications (https://login.gatech.edu/cas/login?service=http%3a%2f%2fprx.library.gatech.edu%2flogin%3fqurl%3dezp.2aHR0cHM6Ly9jb21wYXNzLmFzdG0ub3Jn)

Additional Materials/Resources

1) AASHTO Guide Specifications for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements, 1st Edition.

2) Available from the Georgia Tech Library
   - ASCE 7- Minimum Design Loads for Buildings and Other Structures
   - The International Building Code (IBC)

Course Website

Course announcements and additional handouts can be accessed via: canvas.gatech.edu

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

Any student with learning needs that require special accommodation shall contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss the special needs and to obtain an accommodations letter.

Attendance and/or Participation

Students are expected to attend classes and participate in class discussion on a regular basis. Students who are absent from class are responsible for any missed work.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

1) Homework and project assignments must be turned in by the end of the lecture on the due date. Late homework assignments will be corrected but will receive zero grade credit.
2) Students are expected to take tests and the final examination at the assigned time. Make –up tests and final examination(s) can only be arranged when accompanied by persuasive and valid reasons or when are in accordance with the "approved Institute activities" (http://www.catalog.gatech.edu/rules/4/

Student Use of Mobile Devices in the Classroom

No cell phone use for making/receiving calls, text messaging, or checking emails is allowed.

Notebook, laptop, or tablet computer usage is permitted only if these devices are used to take notes or to perform specific tasks during the lecture.

Campus Resources for Students

There is a wide range of campus resources available to Georgia Tech students. This includes:

The Center for Academic Success: (http://www.success.gatech.edu/) offers a variety of academic support services to help students succeed academically at Georgia Tech (e.g. tutoring, peer-led study groups, study skills, etc.).

The Communication Center (http://www.communicationcenter.gatech.edu/) provides support for students with respect to developing competency and excellence in written, oral, visual, electronic, and nonverbal communication.

The Library: (http://www.library.gatech.edu/) provides students with many services besides borrowing privileges including access to technology and technical assistance, online access to many journals and databases, and subject and personalized research assistance. You can place course materials on reserve behind the reference desk or request a librarian teach an instructional session for your class.

The Office of Disability Services: (disabilityservices.gatech.edu/) ensures that students with disabilities have equal access to all programs and activities offered at Georgia Tech. They provide documentation and officially sanctioned requests for accommodation for students, and serve as a resource for instructors as they build learning environments to meet the needs of all students.

OMED: Educational Services: (omed.gatech.edu/) is the unit charged by Georgia Tech with the retention, development, and performance of the complete student learner who is traditionally underrepresented: African American, Hispanic, and Native American. OMED's programming and academic support services are aimed at equipping all students with strategies to navigate the Georgia Tech environment.

The Division of Student Life: (studentlife.gatech.edu/) – often referred to as the Office of the Dean of Students – offers resources and support for all students in our community. You can refer students to Student Life, or contact them for help identifying appropriate campus resources and resolving problems with students.

Support for Students in Distress Counseling Center: (http://www.counseling.gatech.edu/) 404-894-2575

Dean of Students (Student Life): (http://www.studentlife.gatech.edu/) 404-385-8772

GT Police: (http://www.police.gatech.edu/) 404-894-2500

Stamps Health Services: (http://www.health.gatech.edu/) 404-894-1420