

STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK



MASTER SYLLABUS

CIVL 305 – Nonmetallic Concrete Design

CIP Code: 15.0201

*For assistance determining CIP Code, please refer to this webpage
<https://nces.ed.gov/ipeds/cipcode/browse.aspx?v=55>
or reach out to Sarah Todd at todds@canton.edu*

Created by: Saeid Haji Ghasemali

Updated by:

**Canino School of Engineering Technology
Department: Civil and Construction Technology
Semester/Year: Spring 2024**

A. TITLE: Nonmetallic Concrete Design

B. COURSE NUMBER: CIVL 305

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

Credit Hours: 3

Lecture Hours 2 per Week

Lab Hours 2 per Week

Other per Week

Course Length (# of Weeks): 15 weeks

D. WRITING INTENSIVE COURSE: No

E. GER CATEGORY:

Does course satisfy more than one GER category? If so, which one? No

F. SEMESTER(S) OFFERED: (*Fall, Spring, or Fall and Spring*) Spring

G. COURSE DESCRIPTION:

The course on Concrete Structure with GLASS Fiber-Reinforced Polymers (GFRP) offers a comprehensive exploration of the utilization of FRP materials in engineering applications. Through a structured curriculum, students will explore into the material properties, analysis techniques, and design principles associated with FRP-based structural elements. This course is designed to equip students with the knowledge and skills necessary to effectively incorporate FRP materials into the design and construction of resilient and efficient structures.

H. PRE-REQUISITES:

CONS 336 (Structural Analysis) and CONS 280 (Civil Engineering Materials)

CO-REQUISITES: None

I. STUDENT LEARNING OUTCOMES:

<u>Course Student Learning Outcome [SLO]</u>	<u>PSLO</u>	<u>GER</u>	<u>ISLO</u>
a) Analyze and design a GFRP reinforced concrete slab			2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO
b) Analyze and design GFRP reinforced concrete beam (rectangular and tee-beam)			2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO
c) Analyze and design a Square Footing for a Single Column			2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO
d) Detail shear GFRP reinforcement for beams			5-Ind, Prof, Disc, Know Skills ISLO ISLO
e) Detail splices and anchorages for GFRP reinforcement			5-Ind, Prof, Disc, Know Skills ISLO ISLO

KEY	<u>Institutional Student Learning Outcomes</u> <u>[ISLO 1 – 5]</u>
ISLO #	ISLO & Subsets
1	Communication Skills Oral [O], Written [W]
2	Critical Thinking <i>Critical Analysis [CA], Inquiry & Analysis [IA], Problem Solving [PS]</i>
3	Foundational Skills <i>Information Management [IM], Quantitative Lit./Reasoning [QTR]</i>
4	Social Responsibility <i>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</i>
5	Industry, Professional, Discipline Specific Knowledge and Skills

J. APPLIED LEARNING COMPONENT: Yes No

If Yes, select one or more of the following categories:

Classroom/Lab

Internship

Clinical Practicum

Practicum

Service Learning

Community Service

Civic Engagement

Creative Works/Senior Project

Research

Entrepreneurship

(program, class, project)

K. TEXTS:

Reinforced Concrete with FRP Bars Mechanics and Design, 1st Edition. By Antonio Nanni, Antonio De Luca, Hany Jawaheri Zadeh: Routledge, ISBN: 9780367864996

L. REFERENCES:

Current Building Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars. American Concrete Institute.

M. EQUIPMENT:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- Exams
- Quizzes
- Design Project(s)
- Homework

P. DETAILED COURSE OUTLINE:

I. Introduction

- A. Concrete and GFRP Reinforced Concrete as a material**
- B. Advantages and Disadvantages of Structural Concrete with GFRP**
- C. ACI Code**
- D. Reinforcing GFRP**
- E. Dead and Live Loads**

II. Fundamental Principles of Bending

- A. Behavior of a concrete beam in flexure**
- B. Analysis of unreinforced beam by the flexure formula**
- C. The internal couple method of analysis**
- D. The strength design method for composite material**

III. Analysis and Design of Rectangular Reinforced Concrete Beams

- A. Balanced, Over-reinforced, and Under-reinforced Beams**
- B. Criteria for a tension controlled section**
- C. Detailing requirements**
- D. Load Factors**
- E. Strength reduction factors and the maximum practical moment**
- F. Rectangular Beam Analysis for Moment (Tension Reinforcement only)**

G. Rectangular Beam Design for Moment (Tension Reinforcement only)

IV. Slabs

- A. Slab nomenclature**
- B. ACI Criteria for one-way slabs**
- C. Slab analysis**
- D. Slab design**
- E. Design of slabs on grade**

V. Tee Beams

- A. Tee Beam Analysis for Moment (Tension Reinforcement only)**
- B. Tee Beam Design for Moment (Tension Reinforcement only)**

VI. Design of Shear Reinforcement in Beams

- A. Introduction**
- B. Analysis of beams with no shear reinforcement**
- C. ACI Code requirements for shear GFRP**
- D. Shear Reinforcement Design Procedure**

VII. Development Length - Introduction

- A. Development Length - Tension Bars**
- B. Development Length - Standard Hooks in Tension**
- C. Development of Web Reinforcement**
- D. Splices**
- E. Cutoff of tension bars**
- F. Design of additional shear reinforcing in zones where tension bars are terminated**

VIII. Footings

- A. Introduction**
- B. Design of Square Reinforced Concrete Footings**

Q. LABORATORY OUTLINE: None