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

MASTER SYLLABUS

CONS 282 – Introduction to Structural Engineering Design

CIP Code: 15.0201

Created by: Saeid Haji Ghasemali
Updated by:

School: Canino School of Engineering Technology
Department: Civil and Construction Technology
Implementation Semester/Year: Spring 2026

A. TITLE: – Introduction to Structural Engineering Design

B. COURSE NUMBER: CONS 282

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

# Credit Hours	**3**
# Lecture Hours per Week	**2**
# Lab Hours per Week	**2**
Other per Week	

D. WRITING INTENSIVE COURSE:

Yes	
No	x

E. GER CATEGORY:

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. SEMESTER(S) OFFERED:

Fall	
Spring	x
Fall and Spring	

G. COURSE DESCRIPTION:

This introductory course in structural engineering design focuses on the modeling and basic design of reinforced concrete and steel members using SAP2000 software. The course bridges fundamental structural concepts with hands-on application. Students will learn very basic theoretical concepts related to the behavior of structural members—such as tension, compression, and flexural elements—and apply this knowledge through software-based modeling. They will model simple structural elements such as plates, columns, and beams under applied loads and assess their adequacy using Load and Resistance Factor Design (LRFD) and Allowable Stress Design (ASD) methodologies, in accordance with ACI 318 and AISC specifications. Emphasis is placed on understanding basic structural behavior, interpreting code-based design results, and developing practical modeling skills through individual labs and a team-based design project.

H. PRE-REQUISITES:

CONS 280 (Civil Engineering Materials); or permission of the instructor.

CO-REQUISITES: ENGS 203 (Strength of materials)

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
a. Describe the fundamental principles of structural design, including the purpose and differences between ASD and LRFD methodologies.	SO 2, SO1		ISLO 2 (PS) and ISLO 5
b. Identify basic structural member types (tension, compression, flexure) and their roles in concrete and steel structures.	SO 2, SO1		ISLO 2 (PS) and ISLO 5
c. Use SAP2000 to model simple structural elements such as plates, beams, and columns.	SO 2, SO1		ISLO 2 (PS) and ISLO 5
d. Apply appropriate loads and load combinations in SAP2000 based on structural design codes (ACI 318 and AISC)..	SO 2, SO1		ISLO 5
e. Interpret SAP2000 analysis and design output to assess whether basic concrete and steel members meet code-based performance criteria.	SO 2, SO1		ISLO 5

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

J. APPLIED LEARNING COMPONENT:

Yes	x
No	

If yes, select [X] one or more of the following categories:

Non-Clinical Practicum	x	Community Service	
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS:

Steel Design, 6th Ed., William T. Segui, (2017) Cengage Learning
Darwin, D., Dolan, C., Design of Concrete Structures, 16th Edition. New York, NY: McGraw Hill Education. ISBN: 978-1-264-07114-2.

L. REFERENCES:

Current Building Code Requirements for Structural Concrete and Commentary. American Concrete Institute, AISC ASD/LRFD Manual of Steel Construction, current Edition

M. EQUIPMENT: None

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Exams
Quizzes
Design Project(s)
Homework

P. DETAILED COURSE OUTLINE:

I. Introduction to Structural Systems and Materials
A. Overview of Structural Engineering and Common Systems
B. Introduction to Concrete and Steel as Structural Materials
C. Roles of Structural Codes: ACI 318 (Concrete) and AISC (Steel)
D. Basic Concepts of Load Types: Dead, Live, and Factored Loads
E. Overview of Design Philosophies: LRFD and ASD
F. Introduction to SAP2000: Modeling, Analysis, and Design Capabilities

II. Fundamentals of Reinforced Concrete Design (Using ACI 318 + SAP2000)
A. General Behavior of Concrete in Bending, Shear, and Compression
B. Basic Theory of Reinforced Concrete Beams and Columns
C. Introduction to Concrete Section Types: Rectangular and Tee Beams
D. Overview of Flexural and Shear Design Principles
E. Basics of Short Column Behavior and Eccentric Loading

III. Fundamentals of Steel Design (Using AISC + SAP2000)
A. General Behavior of Steel in Tension, Compression, bending
B. Overview of Tension and Compression Member Concepts
C. Basics of Beam Behavior and Moment Strength
D. Introduction to Beam-Column Interaction (Combined Axial and Bending)

IV. Project-Based Software Application and Team Design
A. Step-by-Step SAP2000 Workflow for Structural Design
B. Team-Based Structural Design Project (Concrete + Steel)
- Modeling, Loading, Analysis, and Design
- Generating Design Reports and Drawings

C. Final Presentation and Submission of Design Package

Q. LABORATORY OUTLINE:

The 2-hour lab session will be used to engage the student in lengthy problem solutions associated with current lecture topics.

I. Modeling Load Combinations and Design Parameters
A. Manual vs auto load combinations in SAP2000
B. Setting up dead, live, and other loads (wind/seismic if desired)
C. Design preferences: selecting design code, factors, and checks
D. Reviewing load paths and how loads transfer through members
E. Understanding demand vs capacity ratios and safety factors

II. Modeling and Analysis of a Tension Member (Steel Plate, Angles)

A. Geometry modeling of a simple steel plate in tension
B. Assigning steel material properties and cross-sectional data (AISC shapes)
C. Applying axial tensile loads
D. Meshing and element types for tension modeling
E. Running the analysis and reviewing axial force results
F. SAP2000 design check using AISC specifications
G. Interpreting adequacy of the selected section

III. Modeling and Analysis of a Compression Member (Column)
A. Creating a short column model with boundary conditions (fixed/fixed or pinned/pinned)
B. Assigning materials (steel or concrete) and cross-sections
C. Applying axial compressive load
D. Load combinations (factored vs service)
E. Design check using AISC or ACI 318
F. Interpreting strength, slenderness effects, and design output

IV. Modeling and Analysis of a Beam (Flexural Member)
A. Geometry setup for a simply supported beam
B. Applying point load, uniform load, and combinations
C. Assigning section properties (concrete or steel)
D. Viewing shear force, bending moment, and deflection diagrams
E. Code-based design check (flexure and shear) using ACI or AISC
F. Determining if section satisfies code criteria

V. Concrete Member Design with ACI 318
A. Material property input for concrete and reinforcing steel
B. Modeling a reinforced concrete beam and short column
C. Assigning rebar layouts and cover
D. Running design using ACI 318
E. Reviewing provided vs required reinforcement

VI. Steel Member Design with AISC
A. Modeling of typical structural steel sections (W-shapes, channels)
B. Design of a tension member, compression member, and beam in steel
C. Code-based design checks: yielding, buckling, and lateral-torsional buckling
D. Reviewing SAP2000 design output and interpreting results