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

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
MECH 417 – APPLIED FINITE ELEMENT METHOD

Created by: Dr. Lucas Craig

Updated by:

Canino School of Engineering Technology

Department: MET

Semester/Year: Spring 2019

A. **TITLE**: Applied Finite Element Method

B. **COURSE NUMBER:** MECH 417

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

 # Credit Hours: 3
 # Lecture Hours: 2 **per week**
 # Lab Hours: (1) two-hour lab **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☒ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

This course introduces the student to modeling and analysis of mechanical systems via the finite element method. Topics include the theory and procedures to design computer models to simulate various applied mechanical problems, validation of computer models, and interpretation of numerical results, mesh and accuracy analysis, and discussion of conclusions. Students will use FEM software to solve various mechanical and heat transfer problems.

H. **PRE-REQUISITES: None** ☒ **Yes** ☒ **If yes, list below:**

MECH 232 MATH 364

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
Demonstrate the fundamental theory of the Finite Element Method.	1,2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Build computer models for a mechanical system.	1		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Create 1D, 2D and 3D meshes.	6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Define boundary conditions and load analysis.	1, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Select appropriate mechanical models.	1,2,6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Analyze model convergence, stability, and accuracy.	1,2,6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets

Perform model validation.	1,2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

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**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

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

☒ Classroom/Lab
☐ Internship
☐ Clinical Placement
☐ Practicum
☐ Service Learning
☐ Community Service
☐ Civic Engagement
☐ Creative Works/Senior Project
☐ Research
☐ Entrepreneurship (program, class, project)

K. TEXTS:

Moaveni, Saeed. Finite Element Analysis: Theory and application with ANSYS, 2nd Ed. Pearson Education., 2003.

L. REFERENCES:

N/A

M. EQUIPMENT: None ☒ Needed:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Homework	**25%**
Exams (3)	**60%**
Final Exam / Project	**15%**

P. DETAILED COURSE OUTLINE:

I. Introduction to Finite Element Method (FEM)
- **A. What is FEM**
- **B. Background of FEM**
- **C. Applications of FEM**

II. FEM Solution Procedures
- **A. Introduction**
- **B. Problem Setup**
- **C. Discrete Mesh Generation**
- **D. Material and Section Properties**
- **E. Boundary Conditions and Load Analysis**
- **F. Mechanical Model Assembling**
- **G. Creating and Submitting FEM Jobs**
- **H. Results and Visualization**

III. Governing Equations for FEM

A. Introduction
B. BEAM Analysis
C. Plate\Shell\Composite and Solid Analysis
D. Linear/Non-Linear Structural Analysis
E. Vibration Analysis
F. Fatigue Analysis

IV. FEM Techniques

A. Introduction
B. Model Discretization
C. Weight Function
D. Model Validation

V. FEM Solution Analysis

A. Introduction
B. Consistency Analysis
B. Stability Analysis
C. Convergence Analysis

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐