

Course Syllabus

1. **Course number and name:** 020EFIGS4 Finite Element Method
2. **Credits and contact hours:** 4 credits 3x1:15 course hours by week
3. **Instructor's or course coordinator's name:** Fouad KADDAH
4. **Textbook and other supplemental material:**
 - a. Traité de Génie Civil de l'Ecole Polytechnique Fédérale de Lausanne Volume 6: Analyse des structures et milieux continus; Methode des éléments finis; Auteurs Francois Frey et Jaroslav Jirousek, second edition 2014
 - b. Collection de l'universite de Compiègne: Une présentation de la methode des éléments finis; Auteurs: Gouri Dhatt et Gilbert Touzot (1984)
 - c. A first course in the finite element method, Second edition by Daryl L. Logan Rose-Hulman Institute of Technology (1992)
 - d. Analyse des solides déformables par la méthode des éléments finis; Auteurs: Marc Bonnet et Attilio Frangi; les éditions de l'Ecole Polytechnique de France (2006)
 - e. Finite Element Procedures, Klaus-Jurgen Bathe, Massachusetts Institute of Technology (1996)
 - f. Modélisation Par éléments finis 3ème édition; Auteur: Jean Charles Craveur, Dunod (2008)
 - g. Instructor's Class Notes
5. **Specific course information**
 - a. **Catalog description:** Practice finite element techniques through concrete examples of heat transfer, material strength, and elasticity theory. The course provides the necessary elements for students to develop their own program and interact appropriately with commercial software.
 - b. **Prerequisites:** None.
 - c. **Required/Elective/Selected Elective:** Required major course for Civil Engineering Specialty students
6. **Specific goals for the course**
 - a. **Specific outcomes of instruction:**
 - Learn how to model and solve a problem by finite elements;
 - Assimilate the numerical and computer implementation of the finite element method for the creation of the student's own program or software
 - Use commercial software reliably and efficiently
 - Interpret and analyze the results of a calculation by the finite elements
 - b. **KPIs addressed by the course:**

KPI	a1	a2	e2	e3	k1	k3
Covered	x	x	x	x	x	x
Assessed						
Give Feedback						

7. Brief list of topics to be covered and approximate number of lectures:

1. General introduction to the finite element method (3 hours)
2. Strong formulation in structural analysis and heat transfer (3 hours)
3. Weak formulation and Galerkin residual weighted method (2 hours)
4. Ritz technique and Finite element technique to solve a weak formulation problem (4 hours)
5. Mesh generation methods (2 hours)
6. Formulation of bar element and beam element in structural analysis (6 hours)
7. Formulation of one-dimensional heat transfer elements (3 hours)
8. Formulation of two-dimensional heat transfer and plane stress/strain analysis (5)
9. Isoparametric formulation and numerical integration (3 hours)
10. Numerical implementation of the finite element method (2 hours)
11. Use of Robot Software for structural analysis problems (2 hours)