



ANNEX 2.1

DEGREE PROGRAM DIDACTIC REGULATIONS INGEGNERIA STRUTTURALE E GEOTECNICA (STRUCTURAL AND GEOTECHNICAL ENGINEERING)

CLASS LM-23

School: Polytechnic and Basic Sciences

Department: Structures for Engineering and Architecture

Didactic Regulations in force since the academic year 2024-2025

Course: Analisi strutturale con gli elementi finiti	Teaching Language: Italian
SSD (Subject Areas): ICAR / 08	CREDITS: 9
Course year: I or II	Type of Educational Activity: Frontal lessons
Teaching Methods: in-person	
Contents extracted from the SSD declaratory consistent with the training objectives of the course: Boundary value problems: Strong form of 1D elastic continua. The finite difference method. Variational form of 1D elasticity problems. The Rayleigh-Ritz-Galerkin Method. The finite element method for 1D problems: Shape functions. Stiffness matrix. Solution of structural equations. Finite elements of higher degree: shape functions. Plane stress and strain problems: Strong form for 2D continua. Shape functions. Stiffness matrix and nodal force vector. Triangular elements: Turner triangular element. Quadratic triangular elements. Quadrilateral elements: Bilinear quadrilateral element. Shear locking. Quadratic quadrilateral elements. Fundamentals of 3D problems. Truss structures: Total potential energy. Truss element. Finite Element Analysis of truss structures. Framed structures: Extension of the Euler-Bernoulli beam model to 3D structures. Strong form as a stationary point of the total potential energy. Weak form. Shape functions. Interpolation of nodal displacements. Basic concepts for the formulation of a beam element. The beam element in its local reference. Local to global reference transformations. Equilibrium of framed structures. Extension of basic beam element. Internal releases. Change of reference and kinematic conditions on degrees of freedom. Linear static analysis of frames. Dynamic analysis of frames: Mass matrix of beams and nodes. Dynamic equilibrium equations. Dynamic analysis methods.	
Objectives: The course aims to provide aspiring engineers with the methodological foundations and operational tools for the analysis of structures and elastic continua by the Finite Element Method. Acquiring the basic knowledge and the methodological approaches typical of Computational Mechanics with particular reference to the Finite Element Method by means of frontal lectures, numerical exercises and programming in MATLAB.	
Propaedeuticities: Continuum and Structural Mechanics Is a propaedeuticity for: FEM in nonlinear structural analysis	
Types of examinations and other tests: During the course written homeworks regarding modelling exercises are assigned. The oral exam include the discussion of assigned homeworks and theoretical aspects presented in the course.	