Syllabus

Descrizione corso

Titolo insegnamento	Finite Element Analysis (FEA)
Codice insegnamento	47556
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	IIND-03/A
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Ingegneria Industriale Meccanica
Altri Corsi di Studio (mutuati)	
Docenti	prof. Franco Concli, Franco.Concli@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/34279
Assistente	
Semestre	Secondo semestre
Anno/i di corso	1
CFU	5
Ore didattica frontale	28
Ore di laboratorio	18
Ore di studio individuale	79
Ore di ricevimento previste	
Sintesi contenuti	The course introduces the theoretical background of the Finite Element Method in order to promote a critical and aware approach to its application in in machine design. It also provides exposure practical design cases to encourage understanding of the broader implications of design. The course introduces the finite element method (FEM) for the analysis of solid structural problems. The background of the finite element method and its solution procedures for linear analysis will be provided and the different type of elements will be introduced.

Argomenti dell'insegnamento	• Introduction to FEM: the method of displacements applied to FEM • Formal Procedure For FEM: discretization, Shape functions, displacement, strain, stress, stiffness matrix, solution, recovery of results. • Bar, Simple Beam, 2D and 3D Beam Element. Property and limitations of beam elements • Plane Elements, Plane stress and plane strain, linear and quadratic triangular and quadrilateral elements. Properties and limitations of plane elements • Isoparametric elements. Properties, limitations • Solid Elements, linear and quadratic tet and hex elements. Solid of Revolution. Properties, limitations. • Theory of Plates and Shells. Finite elements for plates and shells • Theory of composite laminate materials. Orthotropy. Finite elements for orthotropic laminated composite materials Nonlinear analyses, contact analysis, large deformation analysis, modal analysis and structural instability analysis will also be addressed. Beside the theoretical part, students will apply the above-mentioned approaches to some simple benchmark at the beginning and to the design of real mechanical components and systems then In particular a practical case study will be developed by the students in the application part and a report will be issued. The report will be object of discussion in the oral exam.
Parole chiave	FEA
Prerequisiti	None.
Insegnamenti propedeutici	
Modalità di insegnamento	Frontal lectures, exercises, labs, projects, etc.
Obbligo di frequenza	Recommended
Obiettivi formativi specifici e risultati di apprendimento attesi	Intended Learning Outcomes (ILO) By the end of the course, students should be able to: Knowledge and understanding: 1. Know the theoretical bases of the Finite Element Method for the

	solution of structural problems Applying knowledge and understanding: Know how to apply FEA to practical design cases in the field of stress analysis for machine design. Making judgements: 3. Critically analyze the results of FEA simulation, discuss their accuracy, on the basis of the mesh and elements properties 4. Define a FEM model with a tradeoff between the accuracy and the computational effort Communication skills: 5. Prepare a technical report describing the design application, expose and discuss it at the oral exam Ability to learn: 6. Ability to autonomously extend the knowledge acquired.
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	- Formative assessment: In class exercises: 9x120 minutes; ILOs assessed: 2, 3, 4; - Summative assessment: 50% written exam questions; ILOs assessed: 1, 2. 50% report and oral discussion; Quality of the technical report (30%), correctness of the results (20%) Orla discussion (50%); ILOs assessed: 3,4, 5, 6.
Criteri di valutazione	The final mark will be obtained combining the evaluations of the l written test and of the oral examination.
Bibliografia obbligatoria	Lecture notes and documents for exercise will be available on OLE.
Bibliografia facoltativa	Olek C Zienkiewicz, Robert L Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Seventh Edition (ENG) Robert D. Cook, Finite Element modeling for stress analysis, L Wiley & Sons, 1995 (ENG)

Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Innovazione e infrastrutture, Istruzione di qualità