uc3m | Universidad Carlos III de Madrid
Vicerrectorado de Estudios
Apoyo a la docencia y gestión del grado

COURSE: NUMERICAL MODELING OF STRUCTURAL ELEMENTS		
DEGREE: MECHANICAL ENGINEERING	YEAR: 4	TERM: 2

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	TEACHING (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS		DESCRIPTION	CLASS HOURS (1,66=50+50 min)	HOMEWORK HOURS (Max. Estim. 3,25h)
1	1	TOPIC 1: Fundamental concetps. Principle of Minimum Total Potential Energy. Galerkin method.	X			Personal work to acquire basic knowledge and understanding of fundamental concepts related to Galerkin's method.	1.66	3.25
2	2	Introduction the MatLab programming language. Practical session in computer classroom to get started in MatLab programming language, which will be used in successive sessions.		X	Computer	Personal work to acquire basic knowledge about programming in the MatLab environment.	1.66	3.25
3	3	TOPIC 2: The Finite Element Method for bars. Formulation of the bar element in 1D. Stifness, external forces and boundary conditions.	X			Personal work to acquire basic knowledge and understanding of fundamental concepts related to the formulation of the bar element.	1.66	3.25
4	4	Practical session in computer classroom for coding the bar finite element.		X	Computer	Personal work for the understanding of fundamental concepts related to the application of the Principle of Minimum Total Potential Energy and Galerkin's method in one-dimensional problems.	1.66	3.25

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5	5	TOPIC 3: Change of coordinate system for bars. Assembly of global stiffness matrix. Aplicación a estructuras articuladas planas con ejemplos resueltos.	X			Personal work to acquire basic knowledge and understanding of fundamental concepts related to base change and assembly for the bar element.	1.66	3.25
6	6	Practical session in computer classroom to compare exact and approximate FEM solution of 1D elasticity problems.		X	Computer	Personal work for the understanding of fundamental concepts related to the programming of the bar element.	1.66	3.25
7	7	TOPIC 4: Beam element. Formulation and change of coordinate system. Application to frame structures.	X			Personal work for the understanding of fundamental concepts related to the formulation of the beam element.	1.66	3.25
8	8	Practical session in computer classroom for the solution of a truss structure with the FEM.		X	Computer	Personal work for the understanding of fundamental concepts related to the programming of a FEM code for truss struuctures.	1.66	3.25
9	9	TOPIC 5: The Finite Element Method in 2D Elasticity. Formulation of the bilinear quadrilateral element. Stiffness matrix and external forces.	X			Personal work to acquire the basic knowledge and understanding of fundamental concepts related to the 2D quadrilateral element for plane elasticity.	1.66	3.25
10	10	Practical session in computer classroom for the solution of a frame structure with the FEM.		X	Computer	Personal work for the understanding of fundamental concepts related to the programming of a FEM code for frame structures.	1.66	3.25
11	11	TOPICS 6 and 7: Unification of the Finite Element Method. Numerical integration with Gauss quadrature: locking and hourglass.	X			Personal work to acquire basic knowledge and understanding of fundamental concepts related to the use of different elements in the same model, and to the technique of numerical integration.	1.66	3.25

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12	12	Practical session in compiuter classroom for the calculation of eigenfrequencies and eigenfunctions with the FEM.		X	Computer	Personal work for the understanding of fundamental concepts related to the programming of an FEM code to obtain its own frequencies and modes.	1.66	3.25
13	13	TOPICS 8 and 9: Infinite elements. Fracture Mechanics elements. Modeling and post-processing techniques.	X			Personal work of acquiring the basic knowledge and understanding of fundamental concepts related to special finite elements, and with modeling techniques.	1.66	3.25
14	14	Practical session in computer classroom for the solution of shells with the FEM.		X	Computer	Personal work for the understanding of fundamental concepts related to the programming of the plate element.	1.66	3.25
	15	Additional session					1.66	3.25
						Subtotal 1	**25**	**49**
						Total 1 *(Hours of class plus student homework)*	**74**	
15		Tutorials, handing in, etc				Delivery of laboratory reports	1.8	-
16		Assessment				Final exam	4	4
17								
18								
						Subtotal 2	**6**	**4**
						Total 2 *(Hours of class plus student homework)*	**10**	
TOTAL *(Maximun 83 horas)*							**83**	

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