Universidad Carlos III de Madrid
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DENOMINACIÓN ASIGNATURA: Introduction to Fluid Mechanics		
GRADO: Aerospace Engineering	CURSO: 2020-21	CUATRIMESTRE: 1

La asignatura tiene 29 sesiones que se distribuyen a lo largo de 14 semanas. Los laboratorios pueden situarse en cualquiera de ellas.
Semanalmente el alumnos tendrá dos sesiones, excepto en un caso que serán tres.

PLANIFICACIÓN SEMANAL DE LA ASIGNATURA

SEMANA	SESIÓN	DESCRIPCIÓN DEL CONTENIDO DE LA SESIÓN	GRUPO (marcar X)		Indicar espacio distinto de aula (aula informática, audiovisual, etc.)	Indicar SI/NO es una sesión con 2 profesores	TRABAJO SEMANAL DEL ALUMNO		
			GRANDE	PEQUEÑO			DESCRIPCIÓN	HORAS PRESENCIALES	HORAS TRABAJO (Max. 7h semana)
1	1	Fluid mechanics: principles and applications. Solids, liquids and gases. The continuum hypothesis. Density, velocity and internal energy. Local thermodynamic equilibrium. Equations of state.	X				Independent study	1,66	
1	2	Coordinate systems. Eulerian and Lagrangian descriptions. Uniform flow. Steady flow. Stagnation points. Material derivative. Convective flux. Local flow deformation. Rate-of-strain tensor.		X			Independent study	1,66	7
2	3	Reynolds transport theorem. Continuity equation in integral form. Volume and surface forces. Stress tensor. Navier-Poisson law. Forces and moments on submerged bodies.Application on Force and Moment evaluation.	X				Independent study	1,66	7
2	4	Definitions of flow kinematics.		X			Independent study	1,66	

		Trajectories. Paths. Streamlines. Stream function. Acceleration. Circulation and vorticity. Irrotational flow. Velocity potential. Flow kinematics problems K2, K3, K4.							
3	5	Momentum equation in integral form. Application: problem CL6	X				Independent study	1,66	
3	6	Applications of the conservation equations in integral form. Problems CL1		X			Independent study	1,66	7
4	7	Angular momentum equation. Applications: CL3. Heat conduction vector. Fourier's Law. Energy equation in integral form.	X				Independent study	1,66	
4	8	Applications of the conservation equations in integral form. End CL4, CL5		X			Independent study	1,66	
4	9	Applications of the conservation equations in integral form Problems CL11, CL13		X			Independent study	1,66	7
5	10	Navier-Stokes equations. Bernoulli's equation. Initial and boundary conditions. Example: flow around a submerged body.	X				Independent study	1,66	
5	11	LAB 1: The finite difference method. The 1D advection-diffusion equation		X	LAB		Independent study	1,66	7
6	12	Applications of the conservation equations. Problems NS1, CL8	X				Independent study	1,66	
6	13	LAB 2: Introduction to CFD. Overview of numerical methods. Types of meshes. The FLUENT code. ANSYS meshing tools: geometry and mesh generation. Application to a simple case: A 2D Wing		X	LAB		Independent study	1,66	7
7	14	Applications of the conservation equations in differential form Problems NS2, NS3	X				Independent study	1,66	
7	15	LAB 3: Forces on a 2D airfoil as function of the angle of attack. Integral balances of mass & momentum.		X	LAB		Independent study	1,66	7
8	16	Applications of the conservation equations in differential form. Problems NS7, NS8	X				Independent study	1,66	7
8	17	LAB 4. laboratory session: the free fall of a sphere within different liquids. Experimental data		X	LAB		Independent study	1,66	

		acquisition and processing. Relevant dimensionless numbers							
9	18	MIDTERM	X				Independent study	1,66	
9	19	Fluid statics. The standard atmosphere. Hydrostatics. Applications		X			Independent study	1,66	7
10	20	Dimensional analysis. The Pi theorem. Pressure loss in a pipe. Flow over a sphere.	X				Independent study	1,66	
10	21	Taylor solution. Nondimensionalization of the Navier-Stokes equations. Dimensionless numbers in fluid mechanics.		X			Independent study	1,66	7
11	22	Unidirectional flow in channels and pipes. Poiseuille and Couette solutions. Unsteady viscous flow: Rayleigh and Stokes solutions	X				Independent study	1,66	
11	23	Applications of dimensional analysis. Problems DA1, DA2		X			Independent study	1,66	7
12	24	Unsteady effects in viscous flows. Flows with slowly varying cross section.	X				Independent study	1,66	
12	25	Applications of dimensional analysis. Problems DA5, VF11		X			Independent study	1,66	7
13	26	Introduction to hydrodynamic lubrication. The wedge effect. Applications of hydrodynamic lubrication	X				Independent study	1,66	
13	27	Applications of viscous flow in channels and pipes. Problems VF13, VF18		X			Independent study	1,66	7
14	28	Aplications of hydrodynamic lubrication Problems VF6, VF8	X				Independent study	1,66	
14	29	SECOND PARTIAL EXAM	X				Independent study	1,66	7
							Subtotal 1	**48,33**	**98**
		Total 1 *(Horas presenciales y de trabajo del alumno entre las semanas 1-14)*						146,33	
15		Recuperaciones, tutorías, entrega de trabajos, etc							
16		Preparación de evaluación y evaluación						3	
17									
18									30,66
							Subtotal 2	**3**	**30,66**
		Total 2 *(Horas presenciales y de trabajo del alumno entre las semanas 15-18)*						33,66	
TOTAL *(Total 1 + Total 2. Máximo 180 horas)*								**180**	