Universidad Carlos III de Madrid
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COURSE: TRANSPORT PHENOMENA IN BIOMEDICAL ENGINEERING (15547)		
DEGREE: BIOMEDICAL ENGINEERING	YEAR: 2016/2017	TERM: 1st Term

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

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	Indicate YES/NO If the session needs 2 teachers	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	Introduction to Transport in Biological Systems	X			NO	Introduction to Transport in Biological Systems, The Role of Transport Processes in Biological Systems, Definition of Transport Processes, Relative Importance of Convection and Diffusion, Transport Within Cells, Transcellular Transport, Physiological Transport Systems, Application of Transport Processes in Disease Pathology, Treatment, and Device Development (Ch 1)	1,6	5
1	2	Use of matlab in transport		X	X	YES	Matlab plots, 3D streamline plots	1,6	
2	3	Frames of reference, control volume, velocity, stream lines Conservation relationships and fluid statics. Diffusion vs convection. Peclet Number.	X			NO	Fluid Kinematics, velocity fields, derivation of acceleration. Viscosity and Types of Fluids. Conservation Relations and Boundary Conditions, Fluid Statics (pg. 62-70).	1,6	5

2	4	Use of matlab in transport Group 48 / LAB Session for Group 49		X	X	YES	Advanced plots, data interpolation. LAB I on Fluids.	1,6	
3	5	Stress and momentum balance. Fluids, conservation of mass, conservation of momentum.	X			NO	Conservation Relations and Momentum Balances, Conservation Relations and Boundary Conditions (pg. 55-62)	1,6	5
3	6	Use of matlab in transport Group 49 / LAB Session for Group 48		X	X	YES	Advanced plots, data interpolation. LAB I on Fluids.	1,6	
4	7	Surface tension and viscosity. Derivation of Young-Laplace.	X			NO	Surface Tension, Constitutive Relations (pg. 70-79).	1,6	6
4	8	Laminar and turbulent flow . Pressure driven Flow		X		NO	Laminar and Turbulent Flow (pg. 82-88). Application of momentum balances(pg. 88-97)	1,6	
5	9	LAB II – DATA ANALYSIS IN FLOW		X		NO	LAB II – DATA ANALYSIS IN FLOW	1,6	6
5	10	Conservation of Momentum in 3D.	X			NO	Conservation Relations for Fluid Transport, Dimensional Analysis, and Scaling (pg. 120-136)	1,6	
6	11	Navier Stokes Equation		X		NO	Differential Form of the Conservation of Linear Momentum and the Navier–Stokes Equations in Three Dimensions (pg. 120-136)	1,6	1
6	12	Low Reynolds flow around a sphere	X			NO	Derivation of stoke's drag force for low Reynolds flow around a sphere.	1,6	
7	13	Matlab applied to Stokes equation Ggoup 48/ LAB III Group 49		X	X	YES	Matlab used to plot in 2D dynamically low Reynolds flow around a sphere. LAB III on Diffusion	1,6	6
7	14	Stoke's law and particle in gravity. Integral cons. of Mass	X			NO	Integral form of conservation of momentum	1,6	
8	15	Matlab applied to Stokes equation Ggoup 49/ LAB III Group 48		X	X	YES	Matlab used to plot in 2D dynamically low Reynolds flow around a sphere. LAB III on Diffusion	1,6	6
8	16	Bernuilli's equation. Overview on fluids.	X			NO	Bernoulli's equation (pg. 177-187). Overview on pressure driven flow, stress, Stoke's equation for Mid Term Exam	1,6	
9	17	MID TERM EXAM	X			NO	MID TERM EXAM	1,6	6
9	18	Diffusion. Mass Transport – Solute fluxes and diffusion	X			NO	Mass Transport in Biological Systems , Conservation Relations, Constitutive Relations , Diffusion as a Random Walk (pg. 261-275). Estimation of Diffusion Coefficients in Solution (pg. 275-287)	1,6	
10	19	Matlab used for Monte Carlo simulation to study diffusion.		X	X	YES	Matlab used for monte carlo simulations to derv	1,6	6
10	20	Steady state and unsteady state diffusion in one dimension	X			NO	Steady and Unsteady Diffusion in One Dimension (pg. 288-318)	1,6	

11	21	Unsteady state diffusion continued. FIck's law.		X		NO	Unsteady Diffusion in One Dimension (pg. 300-318)	1,6	1
11	22	Conservation of mass – dilute solutions	X			NO	Fick's Law of Diffusion and Solute Flux, Conservation of Mass for Dilute Solutions (pg. 347-355)	1,6	
12	23	Diffusion and convection		X		NO	Diffusion and Convection (pg. 370-378)	1,6	5
12	24	Overview of diffusion	X			NO	Macroscopic Form of Conservation Relations for Dilute Solutions, Mass Transfer Coefficients , Mass Transfer Across Membranes: Application to Hemodialysis (pg. 378-393)	1,6	
13	25	1D Diffusion through a multilayer		X		NO	Diffusion through a multilayer, solving problems.	1,6	5
13	26	Green's function for diffusion	X			NO	Derivation of the Green function for cw diffusion.	1,6	
14	27	Steady and unsteady state conduction		X		NO	Steady and Unsteady Heat Conduction (pg. 778-788)	1,6	5
14	28	Convection	X			NO	Convective Heat Transfer (pg. 788-793)	1,6	
	29	The bioheat transfer equation		X		NO	The Bioheat-Transfer Equation, Cryopreservation (pg. 808-811)	1,6	
							Subtotal 1	**48,33**	**68**

Total 1 *(Hours of class plus student homework hours between weeks 1-14)*	116,33

15		Tutorials, handing in, etc						12	
16		Assessment						3	
17									
18									
							Subtotal 2	**3**	

Total 2 *(Hours of class plus student homework hours between weeks 15-18)*	15

TOTAL *(Total 1 + Total 2. Maximum 180 hours)*	**131,33**