



SUBJECT: Complex systems: Advanced Topics and Applications		
MASTER: Mathematical Engineering	YEAR: 2nd	TERM: 2nd

PLANIFICACIÓN SEMANAL DE LA ASIGNATURA									
WEEK	SESSION	DESCRIPTION	GROUP				WEEKLY PROGRAMMING FOR STUDENTS		
							DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h.)
1	1	<u>Presentation and Introduction</u>						1,5	7
1	2	<u>Reaction and diffusion systems: - Diffusion equation</u>						1,5	
2	3	Models for animal dispersal						1,5	7
2	4	- Nonlocal effects and long range diffusion						1,5	
3	5	- Reaction-diffusion models						1,5	7
3	6	<u>Traveling waves in non-lineal systems: - Basics</u>						1,5	
4	7	- Fisher-Kolmogoroff equation						1,5	7
4	8	- Waves in other systems						1,5	
5	9	- Waves in excitable media						1,5	7
5	10	<u>Pattern formation: - Introduction</u>						1,5	
6	11	- Basics of the linear stability analysis						1,5	7
6	12	- Models featuring linear instabilities						1,5	
7	13	- Basics of the non-linear analysis						1,5	
7	14	- Non-linear models of pattern formation						1,5	7
8	15	- Amplitude equations						1,5	

8	16	<u>Introduction: Systems biology, synthetic biology: Mathematical models in biology</u>						1,5	7
9	17	<u>Modeling of chemical reaction networks</u>						1,5	
9	18	<u>Biochemical kinetics</u>						1,5	7
10	19	<u>Gene regulatory networks</u> - Gene expression models						1,5	
10	20	- Genetic switches						1,5	7
11	21	- Genetic oscillators						1,5	
11	22	- Intercellular communication						1,5	7
12	23	- Stochastic modeling of genetic networks						1,5	
12	24	<u>Synthetic biology: where engineering, mathematics and biology meet to design life</u>						1,5	7
13	25	<u>Biological pattern formation</u> - Embryonic development: how to make an organism from a single cell						1,5	
13	26	- Morphogen gradients						1,5	7
14	27	- Pattern formation by lateral inhibition: the Delta-Notch mechanism						1,5	
14	28	- Making patterns from oscillations: vertebrate segmentation						1,5	7

Subtotal 1 **42** **98**

Total 1 (Hours of class plus student homework hours between weeks 1-14)	140
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15		Extra sessions Tutorials, handing in, etc.							6
16		Assessment, evaluation preparation							14
17									
18									

Subtotal 2 **20**

Total 2 (Hours of class plus student homework hours between weeks 15-18)	
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TOTAL (Total 1 + Total 2)	160
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