uc3m | Universidad Carlos III de Madrid

COURSE: ADVANCED MATHEMATICS		
DEGREE: BACHELOR IN AEROSPACE ENGINEERING	COURSE: 2	TERM: 1

28 lectures along 14 weeks

WEEKLY PLANNING

WEEK	SESSION	CONTENTS	GROUP (indicated by X)		STUDENT WORK DURING WEEK		
			THEORY	PRACTICE	DESCRIPTION	LECTURE HOURS	ADDITIONAL WORK (Max. 7h/week)
1	1	**CHAPTER 1: INTRODUCTION** 1.1 Basic models; direction fields 1.2 Classification of differential equations	X		Sections 1.1, 1.2 [BB] and chapter 6 [R].	1.5	6.5
1	2	(*) Exercises about theory content for week 1		X	(**) Additional exercises from collection and textbooks	1.5	
2	3	**CHAPTER 2: FIRST ORDER DIFFERENTIAL EQUATIONS** 2.1 Linear equations; integrating factors 2.2 Separable equations 2.3 Exact equations	X		Sections 2.1-2.3 [BB]; chapters 8-10 [R].	1.5	6.5
2	4	(*) Exercises about theory content for week 2		X	(**) Additional exercises from collection and textbooks	1.5	
3	5	**CHAPTER 3: SECOND ORDER LINEAR EQUATIONS** 3.1 Definitions and examples 3.2 Linear homogeneous equations 3.3 Homogeneous equations with constant coefficients	X		Chapters 11-13 [R].	1.5	6.5
3	6	(*) Exercises about theory content for week 3		X	(**) Additional exercises from collection and textbooks	1.5	

4	7	3.4 Inhomogeneous equations: undetermined coefficients 3.5 Variation of constants	X		Chapters 14-15,18 [R].	1.5	6.5
4	8	(*) Exercises about theory content for week 4		X	(**) Additional exercises from collection and textbooks	1.5	
5	9	**CHAPTER 4: SYSTEMS OF FIRST ORDER LINEAR EQUATIONS** 4.1 Basic theory; higher-order equations 4.2 Explicit solutions of non-homogeneous linear systems 4.3 Planar linear systems	X		Chapters 25-31 [R].	1.5	6.5
5	10	(*) Exercises about theory content for week 5		X	(**) Additional exercises from collection and textbooks	1.5	
6	11	**CHAPTER 5: NONLINEAR SYSTEMS AND STABILITY** 5.1 Planar nonlinear systems 5.2 Stability	X		Chapters 32-37 [R].	1.5	6.5
6	12	(*) Exercises about theory content for week 6		X	(**) Additional exercises from collection and textbooks	1.5	
7	13	5.3 Periodic solutions 5.4 Higher-dimensional systems	X		Chapters 36-37 [R].	1.5	6.5
7	14	**Mid-term exam 1** (*) Exercises about theory content for week 7		X	(**) Additional exercises from collection and textbooks	1.5	
8	15	**CHAPTER 6: PARTIAL DIFFERENTIAL EQUATIONS: INTRODUCTION** 6.1 Examples and physical derivation 6.2 Types of equations and data; well vs ill-posed problems	X		Chapter 1 [H].	1.5	6.5
8	16	(*) Exercises about theory content for week 8		X	(**) Additional exercises from collection and textbooks	1.5	
9	17	**CHAPTER 7: SEPARATION OF VARIABLES** 7.1 Problem resolution by separation of variables	X		Chapter 2 [H].	1.5	6.5
9	18	(*) Exercises about theory content for week 9		X	(**) Additional exercises from collection and textbooks	1.5	
10	19	7.2 Fourier trigonometric series: basic properties	X		Sections 3.1-3.3 and 4.1-4.5 [H].	1.5	6.5
10	20	(*) Exercises about theory content for week 10		X	(**) Additional exercises from collection and textbooks	1.5	
11	21	**CHAPTER 8: STURM-LIOUVILLE PROBLEMS** 8.1 Sturm-Liouville problems	X			1.5	6.5

		8.2 Self-adjoint operators and spectrum 8.3 Rayleigh's quotient			Sections 5.1-5.6 [H].		
11	22	(*) Exercises about theory content for week 11		X	(**) Additional exercises from collection and textbooks	1.5	
12	23	8.4 Generalized Fourier series 8.5 Multivariable Sturm-Liouville problems	X		Sections 5.7, 5.8, 7.1-7.3, 7.5, and 7.7 [H].	1.5	6.5
12	24	**Mid-term exam 2** (*) Exercises about theory content for week 12		X	(**) Additional exercises from collection and textbooks	1.5	
13	25	**CHAPTER 9: NON-HOMOGENEOUS PROBLEMS** 9.1 Shifting the data 9.2 Fredholm's alternative	X		Sections 8.1, 9.4 [H].	1.5	6.5
13	26	(*) Exercises about theory content for week 13		X	(**) Additional exercises from collection and textbooks	1.5	
14	27	9.3 Eigenfunction expansions	X		Sections 8.2-8.6 [H].	1.5	6.5
14	28	(*) Exercises about theory content for week 14		X	(**) Additional exercises from collection and textbooks	1.5	6.5
						Subtotal 1	**42** **91**
					Total 1 *(Lecture hours plus additional work, weeks 1 through 14)*		133

15		Additional lectures, tutorial sessions, etc.				2	
16		Final exam (preparations; attendance)				3	12
17							
18							
						Subtotal 2	**5** **12**
					Total 2 *(Lecture hours plus additional work, weeks 15 through 18)*		17

TOTAL *(Subtotal 1 + Subtotal 2. Maximum 180 hours)*	**150**

NOTES:

(*) Discussion of selected exercises from the course collection, related with the theory session of the week

(**) Discussion of selected exercises from the course collection and from the recommended textbooks, related with the theory session of the week

[BB] J. R. Brannan and W. E. Boyce, *Differential equations with Boundary Value Problems* (Wiley, 2010).

[H] R. Haberman, *Applied Partial Differential Equations*, 4th edition (Pearson, 2004).

[R] J. C. Robinson, *An Introduction to Ordinary Differential Equations* (Cambridge University Press, 2004).