uc3m

COURSE: VECTOR CALCULUS		
DEGREE: Applied Mathematics and Computation	YEAR: 1	TERM: 2

WEEK	SESSION	DESCRIPTION	GROUP		WEEKLY PROGRAMMING FOR STUDENTS		
			LECTURE	SEMINAR	NOTES	LECTURE HOURS	STUDENT WORK
1	1	**1. TOPOLOGY OF R^n** 1.1. The Euclidean Space R^n 1.2. Open sets 1.3. Closed sets	X		Section 2.2 [MT]	1.66	6
	2	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
2	3	**2. FUNCTIONS OF SEVERAL VARIABLES. LIMITS AND CONTINUITY.** 2.1. Functions of n variables 2.2. Functions, graphs, and level sets	X		Sections 1.4, 2.1, 4.3 [MT]	1.66	6
	4	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
3	5	2.3. Limits and continuity	X		Section 2.2 [MT]	1.66	6
	6	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
4	7	**3. DIFFERENTIATION** 3.1. Partial derivatives 3.2. Derivative, matrix of derivatives	X		Sections 2.3, 2.4 [MT]	1.66	6
	8	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
5	9	3.3. Properties of the derivative 3.4. The chain rule	X		Section 2.5 [MT]	1.66	6
	10	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
6	11	3.5. Directional derivatives and the gradient vector 3.6. Higher order derivatives 3.7. Differential operators: divergence, curl, Laplacian	X		Sections 2.6, 3.1, 4.4 [MT]	1.66	6
	12	**MIDTERM 1: Chapters 1, 2 & 3.1-3.4**		X	Problem solving of selected exercises	1.66	
7	13	**4. EXTREMA OF REAL VALUED FUNCTIONS** 4.1. Taylor polynomial and the Hessian matrix 4.2. Local extrema	X		Sections 3.2, 3.3 [MT]	1.66	6
	14	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
8	15	4.3. Absolute/global extrema	X		Section 3.3 [MT]	1.66	6

Week	Session	Content			Activity / Reading	Class hrs	Homework hrs
		4.4. Free optimization problems					
	16	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
9	17	**5. THE INVERSE AND IMPLICIT FUNCTIONS THEOREMS** 5.1. The inverse function theorem 5.2. The implicit function theorem	X		Section 3.5 [MT]	1.66	6
	18	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
10	19	5.3. Constrained optimization: Lagrange multipliers	X		Section 3.4 [MT]	1.66	6
	20	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
11	21	**6. CURVES** 6.1. Parametrized curves 6.2. Arc length	X		Sections 2.4, 4.1 [MT] Sections 1.2, 1.3, 1.4, 1.5 [dC]	1.66	6
	22	**MIDTERM 2: Chapters 3, 4 & 5**		X	Problem solving of selected exercises	1.66	
12	23	6.3. Plane curves	X		Sections 1.6, 1.7 [dC]	1.66	6
	24	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
13	25	**7. SURFACES** 7.1. Regular surfaces 7.2. Parametrized surfaces 7.3. The tangent plane	X		Sections 2.2, 2.3, 2.4 [dC]	1.66	6
	26	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
14	27	**8. ELEMENTS OF DIFFERENTIAL GEOMETRY** 8.1. First fundamental form 8.2. Oriented surfaces 8.3. Area	X		Sections 2.5, 2.6, 2.7, 2.8 [dC]	1.66	6
	28	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
					Subtotal 1	**48**	**84**
					Total 1 *(Hours of class plus student homework hours between weeks 1-14)*	**132**	
15		Tutorial sessions			Prepare for the final exam	3	3
16-18		Assessment			Prepare for the final exam		12
					Subtotal 2	**3**	**15**
					Total 2 *(Hours of class plus student homework hours between weeks 15-18)*	**18**	
					TOTAL *(Total 1 + Total 2)*	**150**	

References:
- [MT] Marsden and Tromba, "Vector Calculus", W. H. Freeman (6th edition, 2012)
- [dC] Do Carmo, "Differential Geometry of Curves and Surfaces", Dover (2nd edition, 2016)