

**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	<b>1. THE EUCLIDEAN SPACE <math>\mathbb{R}^n</math></b> 1.1. The geometry of Euclidean space $\mathbb{R}^n$ 1.2. Open and closed sets	X		Sections 1.4, 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	<b>2. FUNCTIONS</b> 2.1. Functions of several variables	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	2.2. 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	<b>3. DIFFERENTIATION</b> 3.1. Partial derivatives 3.2. The Derivative and the 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	<b>4. GRADIENT, DIVERGENCE AND CURL</b> 4.1. Directional derivatives and the gradient vector 4.2. Divergence and Curl	X		Sections 2.6, 4.4 [MT]	1.66	6
	12	<b>MIDTERM 1: Chapters 1, 2 &amp; 3</b>		X	Problem solving of selected exercises	1.66	
7	13	<b>5. EXTREMA</b> 5.1. Higher order derivatives 5.2. The Taylor polynomial	X		Sections 3.1, 3.2 [MT]	1.66	6
	14	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
8	15	5.3. Local and global extrema	X		Section 3.3 [MT]	1.66	6
	16	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
9	17	<b>6. THE IMPLICIT FUNCTION THEOREM</b>	X		Section 3.4 [MT]	1.66	6

		6.1. Constrained optimization: Lagrange multipliers					
	18	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
10	19	6.2. The inverse and the implicit function theorems 6.3. The Lagrange multipliers theorem	X		Section 3.5 [MT]	1.66	6
	20	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
11	21	<b>7. CURVES</b> 7.1. Parametrized curves	X		Sections 1.2, 1.3 [dC] Chapter 5 [D] Sections 2.4, 4.1 [MT]	1.66	6
	22	<b>MIDTERM 2: Chapters 4, 5 &amp; 6</b>		X	Problem solving of selected exercises	1.66	
12	23	7.2. The Frenet-Serret trihedron	X		Sections 1.5, 1.6 [dC] Chapters 7, 8 [D] Sections 4.1 [MT]	1.66	6
	24	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
13	25	<b>8. SURFACES</b> 8.1. Parametrized surfaces	X		Sections 2.2, 2.3 [dC] Chapter 10 [D] Sections 7.3 [MT]	1.66	6
	26	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
14	27	8.2. The tangent space	X		Sections 2.4 [dC]	1.66	6
	28	Discussion of selected exercises from the course collection		X	Problem solving of selected exercises	1.66	
15	29	8.3. Area of a surface	X		Sections 2.5 [dC] Chapter 11 [D] Sections 7.4 [MT]	1.66	6
<b>Subtotal 1</b>						<b>50</b>	<b>90</b>
<b>Total 1 (Hours of class plus student homework hours between weeks 1-14)</b>						<b>140</b>	
15		Tutorial sessions			Prepare for the final exam		5
16-18		Assessment			Prepare for the final exam		5
<b>Subtotal 2</b>							<b>10</b>
<b>Total 2 (Hours of class plus student homework hours between weeks 15-18)</b>						<b>10</b>	
<b>TOTAL (Total 1 + Total 2)</b>							<b>150</b>

#### 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)
- [D] Seán Dineen "Multivariate Calculus and Geometry", Springer (Third Edition), 2014