MATH3968 Syllabus and Recommended Reading

Second Semester, 2011

"O'Brien" refers to "Lecture Notes for Differential Geometry, MATH3968" by Nigel O'Brien.
"do Carmo" refers to "Differential Geometry of Curves and Surfaces", by Manfredo do Carmo.
The material listed below under the numbers 1–33 will be spread across lectures 1–38.

	Description	do Carmo	O'Brien
1	Parameterised Curves, Arc Length, Reparameterisation	1.1 – 1.3	2.1 – 2.3
2	Inverse Function Theorem, Curvature, Torsion	1.5	2.3, – 2.5
3	Fundamental Theorem, Frenet Equations, Plane Curves	1.5	2.6
4	Rotation index, Theorem of Turning Tangents	1.7, 5.7	2.6
5	Continuity and Differentiability	Appendix p.118, Appendix A p.256, Appendix C p.266	3.1
6	Implicit Function Theorem, Regular Parameterised Surfaces	2.3	3.2
7	Regular Surfaces, Examples	2.2	3.3
8	Coordinate Changes, Smooth Maps, Surfaces of Revolution	2.3,	
9	Differentials, Tangent Plane, Normal Vectors	2.4	4.1
10	Metric, Area	2.5	4.2
11	Orientation, Möbius strip	2.6	4.1
12	Gauss Map, Second Fundamental Form, Normal/Sectional Curvature	3.2, Appendix p.214	4.3 – 5.2.1
13	Gauss Map in Local Coordinates, Principal Curvatures	3.3	5.2
14	Gauss and Mean Curvatures, (if time: Geometric Meaning of K)	3.3	5.3
15	Surface Review		
16	Minimal Surfaces	3.5B	
17	Minimal Surfaces	3.5B	
18	Isometries, Conformal Maps, Moving Frame	4.2	4.3
19	Christoffel symbols, Gauss' Theorema Egregium, Gauss-Mainardi-Codazzi equations	4.3	7.1
20	Covariant Derivative, Parallel Transport	4.4	6.1 – 6.2
21	Examples	4.4	6.1 – 6.2
22	Geodesics, Geodesic Curvature	4.4	6.3
23	Exponential Map, Special Coordinates, Length Minimising of Geodesics	4.6	
24	Local Gauss-Bonnet	4.5	7.2,7.3
25	Global Gauss-Bonnet	4.5	8.1 – 8.3
26	Applications of Gauss-Bonnet	4.5	8.1 – 8 .3
27	Poincaré-Hopf Index Theorem	4.5	8.4
	mid-semester break		
28	Morse's Theorem	*	*
29	Abstract Surfaces	5.10	9

*: The reference for lecture 28, Morse's Theorem, is do Carmo, "Differential Forms and Applications", section 6.2.

Below, "do Carmo" refers to "Differential Forms and Applications" by Manfredo do Carmo, on reserve in the library.

	Description	do Carmo
30	Differentiable Manifolds, examples	3
31	Vector Fields	3
32	Riemannian Manifolds, covariant derivative, examples	3, **
33	Geodesics in hyperbolic space, immersion/embedding theorems	**
39	Course Review	

**: see O'Brien, chapter 9