

Course Guide Advanced Calculus: Spring 2025:

Date	Topic	Lecture Notes/ Text	Assignment
T: 1-14	vector spaces, norms, topological foundations	p. 9-27 / no need	
R: 1-16	limits, continuity, sequences	p. 9-27 / no need	
M: 1-20	No Class on January 20		
T: 1-21	Frechet derivative, partial differentiation and directional derivatives	p. 29-58 / no need	Mission 1
R: 1-23	one chain rule to rule them all and product rules galore	p. 29-58 / no need	
T: 1-28	higher derivatives, calculus over an algebra, partial derivatives commute	p. 29-58 / no need	Mission 2
R: 1-30	inverse mapping thm, implicit function thm. & implicit differentiation	p. 59-81 / no need	
T: 2-4	an implicit and explicit talk about tangent and normal spaces	p. 83-96 / no need	Mission 3
R: 2-6	optimization on the edge, the Lagrange multiplier technique	p. 83-96 / no need	
T: 2-11	a study of quadratic forms & local extrema	p. 97-116 / no need	Mission 4
R: 2-13	variational calculus (the Euler-Lagrange Equations)	p. 113-132 / no need	
T: 2-18	variational calculus (geodesics & mechanics, showcase of central force problem)	p. 113-132 / no need	
R: 2-20	Examples		Mission 5
T: 2-25	Test 1		
R: 2-27	tensors and their coordinate change	p. 133-165 / Chapter 2	
T: 3-4	wedge products, flux and work form, determinants	p. 133-165 / Chapter 2	
R: 3-6	more on metrics and musical morphisms, Hodge duality introduced	p. 133-165 / Chapter 2	
	March 10-14, Spring Break		
T : 3-18	manifolds, partial differentiation on manifold, derivation, push-forwards	p. 167-214 / Chapter 3	Mission 6
R: 3-20	differentials as the dual basis, tensor fields, exterior derivatives,	p. 167-214 / Chapter 3	
T : 3-25	pull-backs, Lie derivative, flows, Cartan's formula etc.	p. 167-214 / Chapter 3	Mission 7
W: 3-26	Assessment Day: no classes		
R: 3-27	exact and closed forms, Poincare Lemma, potential theory	p. 167-214 / Chapter 4	
T: 4-1	Simplicial Homology	no need / Chapter 5	Mission 8
R: 4-3	Generalized Stokes' Theorem	p. 203-206 / Chapter 6	
T: 4-8	Generalized Stokes' Theorem	p. 203-206 / Chapter 6	Mission 9
R: 4-10	electromagnetism in 4D	p. 215-227 / no need	
T: 4-15	Frobenius Theorem about vectors, forms and foliations,	no need / Appendix F	Mission 10
R: 4-17	Frobenius Theorem about vectors, forms and foliations,	no need / Appendix F	
T: 4-22	Further examples		
R: 4-24	Examples		Mission 11
T: 4-29	Test 2		

Course Guide Advanced Calculus: Spring 2025:

W: 4-30	Reading Day		
	Final Exams Monday May 5, 3:30-5:30pm		

Grading: usual 1000pt scale with:

Test 1 = 250pts,

Test 2 = 250pts,

Missions* = 250pts (3pts per problem, however, I give 90 problems total so you can earn some bonus)

Final = 250pts.

Bonus problems earn 5pts (there are 10 of these given in various missions, you turn them in with the mission)