Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 521		1	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Masters Degree
Objective	-This course aims to introduce the fundamental concepts of differential geometry and the study of differentiable manifolds. Students will learn to use tangent spaces, vector fields, differential forms, and Stokes' theorem in geometric problems.
Content	-Differentiable manifolds, charts and atlases; smooth maps; submanifolds; tangent spaces and tangent maps; submersions, immersions, and embeddings; tangent bundles and vector fields; integral curves and flows; differential forms, exterior algebra, pullbacks, and exterior differentiation; orientation and integration on manifolds; Stokes' theorem; an introduction to de Rham cohomology; applications to curves and surfaces.
References	

Theory Topics

Week	Weekly Contents
1	Review of multivariable calculus: differentiability, inverse function theorem, and constant rank theorem.
2	Differentiable manifolds: charts, atlases, changes of coordinates, and fundamental examples.
3	Smooth maps between manifolds; submanifolds and examples defined by equations.
4	Tangent spaces: definitions using curves and derivations.
5	Tangent maps, chain rule, and the inverse function theorem on manifolds.
6	Submersions, immersions, embeddings, and the regular value theorem.
7	Tangent bundles, vector fields, integral curves, and an introduction to flows.
8	Midterm
9	Cotangent spaces, differential forms, and exterior algebra.
10	Pullbacks of forms, exterior derivative, closed forms, and exact forms.
11	Orientation, manifolds with boundary, and integration of differential forms.
12	Stokes' theorem and classical applications.
13	Introduction to de Rham cohomology and elementary examples.
14	Applications to the geometry of curves and surfaces; general review.