City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_18_ / _19_

Part I Course Overview

Course Title:	**Introduction to Differential Manifolds**
Course Code:	**MA4552**
Course Duration:	**One semester**
Credit Units:	**3 credit units**
Level:	**B4**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**MA3511 Ordinary Differential Equations**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims at providing some basic theory on differential manifolds. It provides students with an introduction to topics in differential manifolds and prepares them for further study in advanced differential geometry.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	explain concepts of differential manifolds, tangent spaces, and submanifolds	25%	√		
2.	understand the theory of submersion, immersion, and embedding	20%	√	√	
3.	explain the concepts of Lie group, Lie algebra, and vector fields.	15%	√		
4.	understand the definitions and theory of vector bundles, fiber bundles, and cotangent bundles	25%	√	√	
5.	Explain the concepts of tensor, Riemannian metric, and Riemannian manifolds	15%			√
	** If weighting is assigned to CILOs, they should add up to 100%.*	100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	**6**	
Lectures	Learning through **teaching** is primarily based on lectures.	√	√	√	√	√		39 hours in total
Take-home assignment	Learning through **take-home assignments** helps students understand basic concepts and theories of curves and surfaces.	√	√	√	√	√		After-class
Math Help Centre	Learning activities in **Math Help Centre** provides students	√	√	√	√	√		After class

	extra help.							
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4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: _40___%								
Test	✓	✓					20	Questions are designed for the first part of the course to see how well students have learned the concepts of differential manifolds
Hand-in assignments (3 or above)	✓	✓	✓	✓			20%	These are skills based assessment to help students understand concepts in differential manifolds.
Formative take-home assignments	✓	✓	✓	✓			0%	The assignments provide students chances to demonstrate their achievements on differential manifolds learned in this course.
Examination: ___60_% (duration: 2 hrs, if applicable)								Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in concepts and theories of differential geometry
** The weightings should add up to 100%.*							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	Ability in problem solving	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Understanding of concepts and applications	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	Study attitude	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Comprehensive ability in independent problem solving	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

Differential manifolds, tangent spaces, submanifolds, Whitney's embedding theorem, vector fields and Lie algebra, vector bundles and cotangent bundles, tensors, Riemannian manifolds.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Introduction to Smooth Manifolds (2nd Edition), J. M. Lee, Springer
2.	Fundamentals of Differential Geometry, S. Lang, Springer
3.	
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	A Comprehensive Introduction to Differential Geometry (I~V), M. Spivak, Publish or Perish, Inc.
2.	
3.	
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