Course Specification

(Postgraduate Programs)

Course Title:	Introduction to Differential Geometry
Course Code:	MAT 6275
Program:	Master of Science in Mathematics
Department:	Mathematics and Statistics
College:	Science
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	2024 – V1
Last Revision Date:	None

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A. General information about the course:

1. Course Identification:

1. Credit hours:				
3((2 Lectures, 0 Lab, 2 Tutorial))				
2. Course type				
A.	☐University	☐ College	☒ Program	☐Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: (Level 3-4 / Year 2)				
4. Course General Description:				
This course introduces the most important ideas and theoretical results of differential geometry. It deals with the essential fundamentals concepts of the geometry smooth manifolds, tangent bunles and cotangent bundles.				
5. Pre-requirements for this course (if any):				
None.				
6. Pre-requirements for this course (if any):				
None.				
7. Course Main Objective(s):				
The objective of this course is to give a detailed knowledge in differential geometry. More precisely, the course is concerned with the geometry of smooth manifold, tangent bundle and cotangent bundle.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	0
3.	**Field**	0

4.	**Tutorial**	**30**
5.	**Others (specify)……**	**0**
	Total	**60**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Identify the list theories and concepts used in Differential Geometry.**	**K1, K2**	**4 lecture hours\week**	**Direct: Regular Exams**
1.2	**Describe recognize the contribution and impacts of differential geometry in Real life problems.**	**K1, K2**	**• 2 tutorial hours\week • Self-study**	**Direct: Short Quizzes**
2.0	**Skills**			
2.1	**Use techniques of proof in differential geometry.**	**S1, S2**	**Self-study**	**Direct: • Participations Short Quizzes**
2.2	**Develop oral communication and technical writing skills through different manifolds.**	**S4**	**Real-life problems**	**Direct: Homework and Mini projects**
2.3	**Analyze Internet in searching for examples of manifolds.**	**S3**	**Real-life problems**	**Direct: Short Quizzes**
2.4	**Choose out deep proofs of the main theorems.**	**S1, S2**	**Self-study**	**Direct: Participations**
3.0	**Values, autonomy, and responsibility**			
3.1	**Work with independence and responsibility.**	**V1, V2**	**Personal questions**	**Direct: Participation**
3.2	**Lead team works.**	**V1, V3**	**Teamwork and class discussions.**	**Direct: Homework and Mini projects**

C. Course Content:

No	List of Topics	Contact Hours
1.	**Differentiable manifolds:** Topological manifolds, Charts, Atlases, Smooth manifolds, Some fundamental examples of smooth manifolds, Smooth maps between two smooth manifolds, Submersions, Immersions, Embeddings, Submanifolds, Examples of submanifolds.	**20**
2.	**Tangent space and vector fields:** Tangent vector and tangent space at a point on a manifold, Tangent bundle of manifold, Vector fields, Lie bracket, Jacobian of a smooth map, One	**20**

	parameter group of transformation, Integral curves on manifolds, Involutive distribution.	
3.	**Cotangent bundle and differential forms:** Differential 1-forms, Pullback of 1-form, Differential forms, Exterior derivatives, de Rham Cohomology, Lie derivative, Interior product, Cartan formula.	**20**
Total		**60**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**HomeWorks, Quizzes, Mini projects**	**During the semester**	**30%**
2.	**Midterm**	**Week 9-10**	**30%**
3.	**Final Exam**	**Week 16-17**	**40%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	• **Lee, J. M.** *Introduction to Smooth manifolds, second edition, graduate text in mathematics. 2012.* • **MILNE-THOMSON, L. M.** *An introduction to Differential Geometry with use of the tensor calculus. Nature, (1942).*
Supportive References	• **Rong, Wang; Yue, Chen.** *An introduction to differential Geometry and topology in Mathematical physics. World Scientific, 1999.*
Electronic Materials	**None**
Other Learning Materials	**None**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (Projector, smart board, software)	**The rooms should be equipped with data show and Smart Board.**

Items	Resources
Other equipment (Depending on the nature of the specialty)	**None**

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Effectiveness of students' assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Other	**None**	

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**