



# Course Specification

— (Bachelor)

**Course Title:** Differential Geometry

**Course Code:** 2024204-3

**Program:** Bachelor in Mathematics.

**Department:** Mathematics and Statistics Department

**College:** Faculty of sciences

**Institution:** Taif university

**Version:** 1

**Last Revision Date:** 20/05/2023



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## A. General information about the course:

### 1. Course Identification

1. Credit hours: 3 (3,0,0)

#### 2. Course type

A.  University  College  Department  Track  Others  
B.  Required  Elective

3. Level/year at which this course is offered: Level 8/ Fourth Year

#### 4. Course general Description:

This course covers basic theory on curves, and surfaces in the Euclidean three space. Topics include: regular curves, Frenet formulas, local theory of curves, global properties of curves such as isoperimetric inequality, regular surfaces, 1st and 2nd fundamental form, Gaussian curvature and mean curvature, Gauss map, special surfaces such as ruled surfaces, surfaces of revolution and minimal surfaces.

#### 5. Pre-requirements for this course (if any):

2022103-3 Geometry & 2022202-4 Calculus III.

#### 6. Co-requirements for this course (if any):

None

#### 7. Course Main Objective(s):

**The student will be taught as follows:**

1. Understanding the basic principles of differential geometry and its various applications.
2. Analyzing the different kinds of curves and surfaces.

### 2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3Hr /Week	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> <li>• Traditional classroom</li> <li>• E-learning</li> </ul>		
4	Distance learning		



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

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	NA
3.	Field	NA
4.	Tutorial	NA
5.	Others (specify)	NA
<b>Total</b>		<b>45</b>

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and understanding</b>			
1.1	Recognize the notion for various curves and surfaces.	K2	<ul style="list-style-type: none"> <li>Lectures</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> </ul>
1.2	Describe the laws and equations of curves and surfaces.	K2	<ul style="list-style-type: none"> <li>Lectures</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Exams</li> <li>Assignments</li> </ul>
<b>2.0</b>	<b>Skills</b>			
2.1	Explain the simple rules of curvatures and torsion and their applications	S4	<ul style="list-style-type: none"> <li>Interactive classes</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> </ul>
2.2	Compare between different forms of curvatures of curves and surfaces.	S4	<ul style="list-style-type: none"> <li>Lectures</li> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Exams</li> <li>Quizzes</li> </ul>
2.3	Evaluate different forms of curvatures of curves and surfaces.	S4	<ul style="list-style-type: none"> <li>Lectures</li> <li>Self-learning through the website</li> </ul>	<ul style="list-style-type: none"> <li>Exams</li> <li>Quizzes</li> <li>Assignments</li> </ul>
<b>3.0</b>	<b>Values, autonomy, and responsibility</b>			
3.1	Show the responsibility for their own learning and continuing personal and professional development.	V2	<ul style="list-style-type: none"> <li>Projects</li> </ul>	<ul style="list-style-type: none"> <li>Oral exams</li> </ul>





Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	Articulate ethical behavior associated with institutional Guidelines in classroom, and in Lab.	V3	<ul style="list-style-type: none"> <li>Group discussions</li> </ul>	<ul style="list-style-type: none"> <li>Assignments</li> </ul>

### C. Course Content

No	List of Topics	Contact Hours
1	Curves and their representations: definition of a curve, regular curves, Parametric representation of curves.	6
2		
3	Natural representation of curves and arc length.	3
4	Definitions of tangent, curvature, normal and bi-normal.	3
5	Tangent, normal and bi-normal lines. Normal osculating and rectifying planes.	3
6	Derivation of the Basic laws of curvature, torsion and Serret-Frenet formulas of the curves.	6
7		
8	First midterm exam	3
9	Regular parametric representation of surfaces.	3
10	Definition of simple surfaces. Tangent and normal planes on surfaces.	3
11	First fundamental form and first factors on surfaces.	3
12	Second fundamental form and second factors on surfaces.	3
13	second midterm exam	3
14	Normal curvature, gaussian curvature, mean curvature and Gauss map of the surfaces.	6
15		
<b>Total</b>		<b>45</b>

### D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%



No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Midterm 2 Exam	12-13	15%
5.	Final Exam	15-16	50%

\*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	<b>Tapp, Kristopher, Differential Geometry of Curves and Surfaces</b> , Springer International Publishing 20016, <b>ISBN 978-3-319-81969-3, ISSN 0172-6056</b> , Department of Mathematics Saint Joseph's University Philadelphia, PA, USA
Supportive References	<b>T. J. Willmore, An Introduction to Differential Geometry (Dover Books on Mathematics) Paperback – January 18, 2012, ISBN-10: 0486486184 ISBN-13: 978-0486486185</b>
Electronic Materials	Lectures available in Blackboard.
Other Learning Materials	--

### 2. Required Facilities and equipment

Items	Resources
<b>facilities</b> (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
<b>Technology equipment</b> (Projector, smart board, software)	Data show, Blackboard
<b>Other equipment</b> (Depending on the nature of the specialty)	None

## F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leader	Direct & Indirect
Effectiveness of Students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Students, Faculty	Indirect





Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	Faculty	Direct & Indirect
Other		

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

### G. Specification Approval

<b>COUNCIL /COMMITTEE</b>	Department Council
<b>REFERENCE NO.</b>	4
<b>DATE</b>	October 2023

