Course Specification
(Bachelor)

Course Title:	**Differential Geometry**
Course Code:	**443MATH-3**
Program:	**B. Sc. In Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2024**
Last Revision Date:	**9/2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:	3

2. Course type

A. University ☐ College ☐ Department ☒ Track☐ Others☐

B. Required ☒ Elective☐

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

Level 7 / Year 4

4. Course general Description

This course is designed to provide students with

- **Curves Theory**: Basic definitions, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves.
- **Surfaces Theory**: Basic definitions, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.

5. Pre-requirements for this course (if any): Math 331

6. Co- requirements for this course (if any): none

7. Course Main Objective(s)

After finishing the course, the student is expected to be familiar with the following:

- Curvature and the torsion of curves.
- Demonstration of the surface area using the coefficients of the 1st fundamental form.
- Classification of the points of surfaces using the coefficients of the 2nd fundamental form.
- Normal and Gaussian torsion of curves.
- Asymptotic lines and main lines of surface.
- Mean torsion of surface.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours

1.	Lectures	42
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	3
5.	Others (specify)	
	Total	45

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Distinguish mathematical concepts relevant to curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	K1	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
1.2	Identify structures and features of Mathematics problems in curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	K2	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
1.3	Explainrequired notations and concepts in curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	K3	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
2.0	Skills			
2.1	Apply aspects relevant to the curves Theory, curvature and torsion of regular curves, Frenet-	S1	Lectures, Web based	Written exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.		work, Classroom discussions.	(Problem solve, MCQ, true/false, Proof, Short answer)
2.2	Compute rates/quantities and Approximate Solutions in curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	S2	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
2.3	Apply various math rules, techniques and theorems in proving curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	S3	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
2.4	Solve mathematical problems using critical thinking and problem solving in proving curves Theory, curvature and torsion of regular curves, Frenet-Serret apparatus, Frenet-Serret theorem, the fundamental theorem of curves, Surfaces Theory, 1st fundamental form and 2nd fundamental form, normal curvature, Geodesic curvature, Gaussian and mean curvatures, asymptotic lines and lines of curvature.	S4	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer)
3.0	Values, autonomy, and responsibility			
3.1	Cultivate a mathematical attitude and nurture the interest.	V1	Group work, problem solving, web based work	Assignments, Discussion

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2	Group work, problem solving, web based work	Assignments, Discussion
3.3	Inculcating values and ethics in thought, expression and deed.	V3	Group work, problem solving, web based work	Assignments, Discussion

C. Course Content

No	List of Topics	Contact Hours
1.	Vectors, Plane curves, Space curves.	6
2.	Curvature of a space curve, Principal coordinate plane equations of a curve.	9
3.	Torsion of a space curve, Frenet Apparatus, Normal unit vector of a surface.	12
4.	First and Second Fundamental forms.	12
5.	Gaussian, Normal and Mean curvatures of a curve.	6
	Total	45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework and Quiz	3	5
2.	First exam	6	20
3.	Homework and Quiz	10	5
4.	Second exam	12	20
5.	Final exam	15	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	- Richard, S. Millman, George, D. Parker, Elements of differential geometry, HALL. INC © 1977.
Supportive References	M. Docarmo, Differentiable curves and surfaces, Princeton Hall, New Jersey, (1976).

	Schaum outlines of theory and problems of differential geometry Martin M. Lipchitz, ph.D.
Electronic Materials	Web sites dedicated to Differential Geometry.
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, Computer lab
Technology equipment (projector, smart board, software)	Data show; Smart Board, Mathematics software
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect(Course Evaluation Survey)-Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other	Students, Program assessment committee	Direct/ Indirect

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	**Board Of Mathematics Department**
REFERENCE NO.	**2417**
DATE	**29/03/1446 A. H.; 2/10/2024 A. D.**