Course Specification
(Bachelor)

Course Title:	Tensors
Course Code:	2024114 -3
Program:	Bachelor in Mathematics
Department:	Mathematics and Statistics Department
College:	Faculty of Sciences
Institution:	Taif University
Version:	1
Last Revision Date:	13/10/2023

Table of Contents

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 7 (4th year)					
4. Course general Description:					
This course covers some topics in advanced vector and tensor analysis is a natural aid in forming mental pictures of physical and geometrical ideas. The focus therefore, is to impart useful skills on the students in order to enhance their Mathematical ability in applying vector technique to solve problems in applied sciences and to equip them with necessary skill required to cope with higher levels courses in related subjects. Topics to be covered in this course include, basic vectors algebra, coordinate bases, gradient, divergence, and curl, Green's, Gauss' and Stokes' theorems. The metric tensor, Christoffel symbols and Riemann curvature tensor.					
5. Pre-requirements for this course (if any):					
Linear Algebra (2022204-3) Ordinary differential equations (2022201-4)					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					

1. Understanding the basic principles of tensor analysis and its various applications.
2. Examining different geometric systems and derive covariant and contravariant tensors about it

Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**3Hr /Week**	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**	45
2.	**Laboratory/Studio**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)**	NA
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	Recognize the notion for various tensors.	K2	• Lectures • Self-learning through the website	• Quizzes • Assignments
1.2	Describe the laws and definitions of covariant derivative.	K2	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills**			
2.1	Explain the Christoffel symbols and their applications.	S2	• Lectures • Self-learning through the website	• Quizzes • Assignments
2.2	Demonstrate the ability for solving mathematical problems involving vectors and tensors.	S2	• Lectures • Group discussions	• Exams • Quizzes
2.3	Apply tensors rules in the solution of some physical problems.	S4	• Lectures • Group discussions	• Exams • Quizzes • Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	Illustrate the concept of personal responsibility for achieving duties by team work	V2	• Projects • Creating working groups with peers to collectively prepare: solving problems and search the internet for some topics	• Through the oral presentation of the projects

C. Course Content

No	List of Topics	Contact Hours
1.	Basic concepts of summation	3
2.	Kronecker delta and its applications	3
3.	Definition of Tensors	3
4.	Metric Tensor and its properties	3
5.	Permutation symbols and tensor	3
6	Distance in different co-ordinate system	3
7.	**Midterm 1 exam**	3
8	Christoffel symbol	3
9	Covariant derivative and	3
10.	Riemann Tensor and its derivation.	3
11	The main properties of Riemann Tensor Revision.	3
12	Bianchi property and Einstien Tensor	3
13	**Midterm2 exam,**	3
14	Calculation of Riemann tensors for some coordinates systems.	3
15.	Revision .	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments, report	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%
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	Schaums Outline of Tensor Calculus, BY David C. Kay, 2011. D. C. Kay "Theory and Problems of Tensor Calculus" McGraw-Hill 1988.
Supportive References	S.Sokolnikoff, Tensor analysis theory and applications, John Wiley and Sons 1951.
Electronic Materials	Lectures available in Blacboard
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Data show, Blackboard
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, Program Leader	Direct & Indirect
Effectiveness of students assessment	Faculty, Program Leader	Direct
Quality of learning resources	Students, Faculty	Indirect
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

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