هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Tensors**
Course Code:	**2024114-3**
Program:	**Bachelor in Mathematics.**
Department:	**Department of Mathematics and Statistics**
College:	**Faculty of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: (3 Hours)	
2. Course type	
a.	**University** ☐ **College** ☐ **Department** √ **Others** ☐
b.	**Required** ☐ **Elective** √
3. Level/year at which this course is offered: **Level 11 (4th year)**	
4. Pre-requisites for this course (if any): **Linear Algebra (2022204-3)** **Ordinary differential equations (2022201-4)**	
5. Co-requisites for this course (if any): **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5Hr /Week	100
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	50
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify) E-Learning There are many items of this course including answered examples and exercises the student should log on his blackboard to get understanding and then solve the exercises	
	Total	50

*** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times**

B. Course Objectives and Learning Outcomes

1. Course Description

It is said that 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.

2. Course Main Objective

In this course, the student should be taught as follows:

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**

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	**Recognize the notion for various tensors.**	**K2**
1.2	**Describe the laws and definitions of covariant derivative.**	**K2**
2	**Skills:**	
2.1	**Explain the Christoffel symbols and their applications.**	**S2**
2.2	**Demonstrate the ability for solving mathematical problems involving vectors and tensors**	**S2**
2.3	**Apply tensors rules in the solution of some physical problems.**	**S4**
3	**Values:**	
3.1	**Illustrate the concept of personal responsibility for achieving duties by team work**	**V2**

C. Course Content

No	List of Topics	Contact Hours
1	Basic concepts of summation Kronecker delta and its applications	**5**
2	Definition of Tensors	**5**
3	Metric Tensor and its properties	**5**
4	Permutation symbols and tensor	**5**
5	Distance in different co-ordinate systems	**5**
6	**Midterm exam,** Christoffel symbol	**5**
7	Covariant derivative Riemann Tensor and its derivation.	**5**
8	The main properties of Riemann Tensor Revision.	**5**
9	Bianchi property and Einstien Tensor	**5**
10	Calculation of Riemann tensors for some coordinates systems. Review p	**5**
Total		**50**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge:**		
1.1	**Recognize the notion for various tensors.**	• Lectures • Self-learning through the website	• Quizzes Assignments
1.2	**Describe the laws and definitions of covariant derivative.**	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills:**		
2.1	**Explain the Christoffel symbols and their applications.**	• Lectures • Self-learning through the website	• Quizzes Assignments
2.2	**Demonstrate the ability for solving mathematical problems involving vectors and tensors**	• Lectures • Group discussions	• Exams • Quizzes
2.3	**Apply tensors rules in the solution of some physical problems.**	• Lectures • Group discussions	• Exams • Quizzes Assignments
3.0	**Values:**		
3.1	**Illustrate the concept of personal responsibility for achieving duties by team work**	• 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.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes + Home works	Continues	10 %
2	Midterm exam	5^{th}-6^{th}	30 %
3	Class Work (Homework- report- class test….)	8^{th}	10 %
4	Final exam	11^{th}	50 %

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

6 hours per week (as defined in the teaching schedule of the faculty member) for academic advice and consultations.
Teaching staff is also available using Blackboard web site and Taif University "Edugate" System.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Schaums Outline of Tensor Calculus, BY David C. Kay, 2011. D. C. Kay "Theory and Problems of Tensor Calculus" McGraw-Hill 1988.**
Essential References Materials	**S.Sokolnikoff, Tensor analysis theory and applications, John Wiley and Sons 1951.**
Electronic Materials	**J. M. Lee, Introduction to smooth manifolds, University of Washington, Dept. of mathematics, 2000**
Other Learning Materials	**Relativistic Mechanics and tensors electronic Journal**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Classrooms which can accommodate up to 50 students and equipped with e-podiums, and internet access.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Laptop, smart board, and projector.**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**None**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Peer Reviewer Students	Direct Indirect
Extent of achieving the course learning outcomes	Peer Reviewer Students	Direct Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department of Mathematics and Statistics**
Reference No.	**11**
Date	**12-7-1443 H**