MTS 301 – Vector and Tensor Analysis

COURSE PARTICULARS

Course Code: MTS 301
Course Title: Vector and Tensor Analysis
No. of Units: 3
Course Duration: Two hours of theory and One hour of Tutorials per week for 15 weeks.
Status: Compulsory
Course Email Address: mts301@gmail.com
Course Webpage: http://www.mts.futa.edu.ng/courseschedule.php?coursecode=MTS%20204
Prerequisite: MTS 104, MTS 210

COURSE INSTRUCTORS

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COURSE DESCRIPTION

This course is designed primarily for those students taking courses in mathematics, physics, mechanics, electromagnetic theory, aerodynamics, geophysics, metrology or any of the numerous other fields in which vector methods are applicable. Vector and tensor algebra have in recent years become basic part of fundamental mathematical background required of those in engineering, sciences and allied disciplines. It is said that vector and tensor analysis is a natural aid in forming mental pictures of physical and geometrical ideas. A most rewarding language and mode of thought for the physical sciences. 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 vector

algebra, coordinate bases, gradient, divergence, and curl, Green's, Gauss' and Stokes' theorems. The metric tensor, Christoffel symbols and Riemann curvature tensor. Applications will be drawn from differential geometry, continuum mechanics, electromagnetism, general relativity theory.

COURSE OBJECTIVES

The objectives of this course are to:

- introduce students to the fundamentals of vector and tensor algebra; and
- expose students to mathematical applications of vector and tensor algebra to handle diverse problems which occur in real life situations.

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:
(Knowledge based)

- understand Vector and tensor algebra and its applications in applied sciences and engineering;
- know the fundamental mathematics of vector and tensor that are important for higher learning
- provide working tools for students in some branches of applied mathematics, physics and geophysics

(Skills)

- develops ability to solve mathematical problems involving vectors and tensors
- competently use vector and tensor algebra as a tool in the field of applied sciences and related fields

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	05%
Assignments	05%
Test(s)	20%
Final Examination	70%
TOTAL	**100%**

GENERAL INSTRUCTIONS

Attendance: It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

Academic Integrity: Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

Assignments and Group Work: Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

Code of Conduct in Lecture Rooms and Laboratories: Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc*.) during lectures. Food and drinks are not permitted in the laboratories.

READING LIST

[1]Murray R. Spiegel (1959). Theory and Problems of Tensor Analysis. SI (Metric) Edition McGraw-Hill International Book Company, New York.

[1]Stroud K. A. (2003). Advanced Engineering Mathematics. Fourth Edition. Palgrave Macmillan

[3,4]Murray R. Spiegel (1967). Theory and Problems of Theoretical Mechanics. SI (Metric) Edition . McGraw-Hill International Book Company, New York.

[4]Lambe G. C.(1980). Advance Level Applied Mathematics. Hodder and Stoughton London.

[3]Weatherburn C. E. (1949). Advanced Vector Analysis with Application to Mathematical Physics. Bell's Mathematical Series, London.

Legend
1- Available in the University Library
2- Available in Departmental/School Libraries
3- Available on the Internet.
4- Available as Personal Collection
5- Available in local bookshops.

COURSE OUTLINE

Week	Topic	Remarks
1-2	Vector in three non-coplanar directions, vector in two non-coplanar directions, magnitude of vector, addition and subtraction of vectors, scalar multiplication and projection	Students should be able to identified vectors in both two and three non-coplanar directions. Also they should be able to calculate the magnitude of a vector, add and subtract two vectors and scalar multiplication of vectors. Furthermore, they should be able to project of one vector to the other.
3 – 5	Scalar and vector products. The scalar and vector triple products. Vector differentiation and integration, position vectors, gradient of scalar field and curl and divergence of vector point function	Students should be able to compute both scalar and vector products and triple products. Also they should be able to apply element of vector calculus to obtain gradient, divergence and curl point functions respectively.
6 – 8	Line, surface, and volume integrals.	Students should be able to solve and apply line, surface and volume integrals to real-life problems.
9 - 12	Green's, Stokes' and Gauss' divergence theorems	Students should be able state, prove and apply all these theorems.
13 – 14	Tensor Analysis	Students should be able formulate tensor representations for vector algebra. Also, they should be able to perform tensor algebra.
15	Revision / Test	