NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
COMPUTER SCIENCE PROGRAM

CM141 – VECTOR CALCULUS

I. GENERAL INFORMATION

CODE	**:**	CM141 Vector Calculus
SEMESTER	**:**	1
CREDITS	**:**	5
HOURS PER WEEK	**:**	6 (Theory – Practice)
CONDITION	**:**	Compulsory
PREREQUISTES	**:**	None

II. COURSE DESCRIPTION

The course prepares students in the understanding and application of the principles of two and three-dimensional vector calculus. Vectors are studied using Euclidean geometry in plane and space. Vector representations of line and plane are analyzed and used to solve diverse problems on parallelism, orthogonality, internal product and vector product.

III. COURSE OUTCOMES

1. Understand and apply the concepts of propositional logic.
2. Recognize and represent data at machine level.
3. Organize the memory system in a processing unit.
4. Modle aand
5.
6. Formulate and analyze line and plane equations.
7. Identify the Euclidean vector space and its corresponding affine space.
8. Determine the distance between two points in 2-D and 3-D spaces, as well as the middle point, and parallel and orthogonal lines and planes.
9. Solve problems with lines planes in 2-D and 3-D spaces.
10. Analyze and solve problems bases on modeling applying Physics and Engineering principles.

IV. COURSE CONTENTS

1. VECTOR IN THE PLANE

Cartesian coordinate systems / Cartesian product RxR / Bi-dimensional vector space / Vector geometric representation / Vector parallelism / Vector length / Internal product in R^2. Properties / Vector orthogonality / Scalar product. Properties / Angle between vectors / Orthogonal projection / Vector orthogonal components / Vector linear combination / Vector lineal independence / Bases

2. VECTOR GEOMETRY IN THE PLANE

Euclidean plane / Point / Line / Distance between two pints / Line equations / Lines relative positions / Lines parallelism / Line orthogonality / Distance from a point to a line / Line

intersection / Simultaneous linear equations / Line slope / Angle between lines / Triangle area / Polygon area.

3. VECTORS IN SPACE

Three-dimensional vector space / Vector equality / Vectors sum / Multiplication of a vector by a real number / Vector geometric representation / Vector parallelism / Vector length / Vector properties / Unit vectors / Scalar product. Properties / Vector orthogonality / Angle between vectors / Orthogonal projection / Vector lineal combination / Vector lineal independence / Bases / Vector product. Geometric definition / Triple scalar product / Vector linear independence and triple scalar product.

4. VECTOR GEOMETRY IN SPACE

Three-dimensional Euclidean space / Point, line and plane / Distance between two points / Line equations / Lines relative positions. Angle between lines / Distance from a point to a line / Distance between two lines / The plane. Equations / Planes relative positions / Planes angle and parallelism / Distance from a point to a plane / Relation between vector linear independence and planes intersection / Parallelogram area / Volume of parallelepiped / Volume of tetrahedron.

V. METHODOLOGY

The course takes place in theory and practice sessions. In theory sessions, the instructor presents the concepts, theorems and applications. In practice sessions, different kinds of problems are solved and the solutions are analyzed. Active participation of students is encouraged in all sessions.

VI. GRADING SYSTEM

The Final Grade (PF) is calculated with the following formula:

PF = (EP + EF + PP) / 3

ME: Mid-term exam EF: Final Exam
PP: Average of quizzes

VII. BIBLIOGRAPHY

1. **J. DE BURGOSS**
   Linear Algebra
   Mc Graw Hill, Ed., 2012, Mexico
2. **HASSER, LASALLE, SULLIVAN**
   Mathematic Analysis
   Trillas Edition, 2000, Mexico
3. **GRANERO RODRIGIEZ**
   Algebra and Analytic Geometry
   Mc Graw Hill, Ed., 2010, Mexico