National University of Engineering (UNI)
School of Cybersecurity
Syllabus 2024-II

1. COURSE

MA101. Math II (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	MA101. Math II
2.2 Semester	:	2^{nd} Semester.
2.3 Credits	:	4
2.4 Horas	:	2 HT; 4 HP;
2.5 Duration of the period	:	16 weeks
2.6 Type of course	:	Mandatory
2.7 Learning modality	:	Face to face
2.8 Prerrequisites	:	MA100. Mathematics I. (1^{st} Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

The course develops in students the skills to deal with models of science and engineering skills. In the first part of the course a study of the functions of several variables, partial derivatives, multiple integrals and an introduction to vector fields is performed. Then the student will use the basic concepts of calculus to model and solve ordinary differential equations using techniques such as Laplace transforms and Fourier series.

5. GOALS

- Apply derivation rules and partial differentation in functions of several variables.
- Apply techniques for calculating multiple integrals.
- Understand and use the concepts of vector calculus.
- Understand the importance of series.
- Identify and solve differential equations of the first order and their applications in chemical and physical problems.

6. COMPETENCES

1) Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions. (Assessment)

6) Apply security principles and practices to maintain operations in the presence of risks and threats. (Assessment)

7. TOPICS

Unit 1: Multi-Variable Function Differential (24 hours)	
Competences Expected:	
Topics	**Learning Outcomes**
• Concept of multi-variable functions. • Directional Derivates • Tangent line, normal plane to curve line and tangent plane, normal line to a curve plan. Know to calculate their equations. • Concept of extreme value and conditional extreme value of multi-variable functions • Applications problems such as modeling total production of an economic system, speed of sound through the ocean, thickener optimization, etc.	• Understand the concept of multi-variable functions. • Master the concept and calculation method of the direction derivative and gradient of the guide. • Master the calculation method of the first order and second order partial derivative of composite functions. • Master the calculation method of the partial derivatives for implicit functions. • Understand tangent line, normal plane to curve line and tangent plane, normal line to a curve plan. Know to calculate their equations. • Learn the concept of extreme value and conditional extreme value of multi-variable functions; know to find out the binary function extreme value. • Be able to solve simple applications problems.
Readings : [**Stewart**], [**DennisZ**]	

Unit 2: Multi-Variable function Integral (12 hours)	
Competences Expected:	
Topics	**Learning Outcomes**
• Double integral, triple integral and nature of the multiple integral. • Method of double integral • Line Integral • The Divergence, Rotation and Laplacian	• Understand the double integral, triple integral, and understand the nature of the multiple integral. • Master the calculation method of double integral (Cartesian coordinates, polar coordinates) the triple integral (Cartesian coordinates, cylindrical coordinates, spherical coordinates). • Understand the concept of line Integral, their properties and relationships. • Know to calculate the line integral. • Master the calculation the rotational, divergence and Laplacian.
Readings : [**Stewart**], [**DennisZ**]	

Unit 3: Series (24 hours)	
Competences Expected:	
Topics	**Learning Outcomes**
• Convergent series • Taylor and McLaurin series • Orthogonal functions	• Master to calculation if series is convergent, and if convergent, find the sum of the series trying to find the radius of convergence and the interval of convergence of a power series. • Represent a function as a power series and find the Taylor and McLaurin Series to estimate function values to a desired accuracy. • Understand the concepts of orthogonal functions and the expansion of a given function f to find its Fourier series.
Readings : [**Stewart**], [**DennisZ**]	

Unit 4: Ordinary Differential Equations (30 hours)	
Competences Expected:	
Topics	**Learning Outcomes**
• Concept of differential equations • Methods to resolve differential equations • Methods to resolve the secod order linear differential equations • Higher order linear ordinary differential equations • Applications problems using Laplace transforms	• Understand differential equations, solutions, order, general solution, initial conditions and special solutions etc. • Master the calculation method for variables separable equation and first order linear equations. Known to solve homogeneous equation and Bernoulli (Bernoulli) equations; understand variable substitution to solve the equation. • Master to solve total differential equations. • Be able to use reduced order method to solve equations. • Understand the structure of the second order linear differential equation. • Master calculation method for the constant coefficient homogeneous linear differential equations; and understand calculation method for the higher order homogeneous linear differential equations. • Know to apply the differential equation calculation method to solve simple geometric and physic application problems. • Solve properly certain types of differential equations using Laplace transforms.
Readings : [**Stewart**], [**DennisZ**]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

********* EVALUATION MISSING ********

10. BASIC BIBLIOGRAPHY