



A) COURSE

Course Id:	Course
0054	Calculus D

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3	2	3	8	80

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	III	III	II	II	II
Course Type (Required/Elective)	Required	Required	Required	Required	Required
Prerequisite Course:	Calculus A	Calculus A	Calculus A	Calculus A	Calculus A
CACEI Classification:	BS	BS	BS	BS	BS

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:

To solve the different ordinary differential equations and have the capacity to apply them to different phenomena of our nature.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- Introduction.		2 hours
Specific Objective:	The student will learn and handle the fundamental concepts of differential equations, as well as the origins of the same in different areas of knowledge.	
1.1 Definition and classifications of a differential equation according to order, degree, type of coefficient and linearity.		
1.2 Types of differential equation solutions: explicit, implicit and formal.		
1.3 Existence of a solution.		
1.4 Origins of differential equations: formulating new mathematical models and laws of physics that involve mathematical models.		
1.5 The meaning of solution and differential equations: geometric, physical and generating an equation from the primitive function.		
Readings and other resources	Bibliography according to the topic and advice.	
Teaching Methodologies	Exhibition topics, analysis of the concepts presented.	
Learning Activities	Assignments and discussion of them.	

2. First order and first degree differential equations.	3 hours
---	----------------



Specific objective:	The student will acquire the ability, through explanations from the teacher, and the solution of problems with his teacher as well as on his own in the laboratory.
	2.1 Solution of equations through variables separable and reducible to this form (homogeneous equations). 2.2 Solution of equations by variables, exact and reducible to them by integrating factor (s). 2.3 Solution of linear and reducible equations to linear ones (bernoulli equation). 2.4 Solution of fraction linear or form translating equations. 2.5 Applications to problems: geometric, physical, reasons and proportions.
Readings and other resources	Bibliography according to the topic and advice.
Teaching Methods	Exhibition topics, analysis of the concepts presented.
Learning Activities	Assignments and discussion of them.

3.- First order and higher degree differential equations.		8 hours
Specific Objective:	The student will learn this type of equations and acquire the necessary ability to solve them by deriving the appropriate equation, which he will do in the laboratory under the guide of the professor.	
	3.1 Solvable equations for "p". 3.2 Solvable equations for "y", Clairaut equation. 3.3 Solvable equations for "x". 3.4 Singular solution and covering. 3.5 Discriminates "p" y "c". 3.6 Applications.	
Readings and other resources	Bibliography according to the topic and advice.	
Teaching Methods	Exhibition topics, analysis of the concepts presented.	
Learning Activities	Assignments and discussion of them.	

4. Solution of the second differential equation by reduction order.		30 hours
Specific Objective:	Since the second order differential equations are those that have many applications in different branches of knowledge, the student will acquire the ability to solve them and recognize the difference between a linear and a non-linear.	
	4.1 The equation does not contain the independent variable. 4.2 The equation does not contain the dependent variable. 4.3 The equation contains the dependent variable and the first square derivative 4.4 the equation is a function of the dependent variable. 4.5 Applications.	
Readings and other resources	Bibliography according to the topic and advice.	
Teaching Methods	Exhibition topics, analysis of the concepts presented.	
Learning Activities	Assignments and discussion of them.	

5. - Linear differential equations with constant coefficients.		5 hours
Specific Objective:	Under professor guidance, the student will learn these equations and acquire the ability to solve them in class as well as in the laboratory and will be able to apply them to different actual problems	



5.1 Basic theory of higher order linear differential equations.	
5.2 Solution of homogenous equation by order reduction, using operators.	
5.3 Solution of the homogenous equation by an auxiliary equation, when having real and different roots, real and repeated roots, and complex roots.	
5.4 Complete solution of a non-homogenous differential equation by; undetermined coefficients and by parameter variation.	
5.5 Cauchy linear equation.	
5.6 Applications.	
Readings and other resources	Bibliography according to the topic and advice.
Teaching Methods	Exhibition topics, analysis of the concepts presented.
Learning Activities	Assignments and discussion of them.

6. The Laplace transform.		5 hours
Specific Objective:	The student will handle this linear transformation and use it to solve differential in a more practical way.	
6.1 General concepts of the transform: definition and conditions of existence.		
6.2 Transforms of the most common functions.		
6.3 Theorems for calculating the transform of other functions.		
6.4 Laplace inverse transform.		
6.5 Solution of differential equations by Laplace transforms.		
Readings and other resources	Bibliography according to the topic and advice.	
Teaching Methods	Exhibition topics, analysis of the concepts presented.	
Learning Activities	Assignments and discussion of them.	

7. Linear differential equation systems.		5 hours
Specific Objective:	The student will acquire the ability to solve differential equation systems, which he may use in solving physical phenomena such as movements on a plane, mass systems coupled to springs and electric networks.	
7.1 Solution by elimination		
7.2 Solution by determinants		
7.3 Solution by Laplace transforms		
7.4 Initial value problems		
7.5 Applications		
Readings and other resources	Bibliography according to the topic and advice.	
Teaching Methods	Exhibition topics, analysis of the concepts presented.	
Learning Activities	Assignments and discussion of them.	

E) TEACHING AND LEARNING METHODOLOGIES

- a) One-hour theory classes for three days plus two hours of lab per week.
- b) The teaching-learning process will be reinforced by homework assignments for each of the topics.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st. Partial Evaluation	16 Session	Exam 80%, Task 20%; (Relative value: 33.3%)	1, 2 y 3



2nd Partial Evaluation	16 Session	Exam 80%, Task 20%; (Relative value: 33.3%)	4 y 5
3rd. Partial Evaluation	16 Session	Exam 80%, Task 20%; (Relative value: 33.3%)	6 y 7
Ordinary Final Evaluation		100 % (Average Partial Ratings)	
Other Activity:			
Extraordinary Exam	Week 17 the semester	Exam 100%	100% Topics
Title Exam	According to the Schedule of the school secretary	Exam 100%	100% Topics
Regularización Exam	According to the Schedule of the school secretary	Exam 100%	100% Topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

1. Zill Dennis G., *Ecuaciones Diferenciales con Aplicaciones de Modelado*, ISBN: 978-607-481-313-5, 9a Ed., CENGAGE Learning, 2009.
2. Ross Shepley L. *Introducción a las Ecuaciones Diferenciales*, 3a Ed., McGraw-Hill, 1993.

Complementary Books

1. Takeuchi-Ramírez-Ruíz, *Ecuaciones Diferenciales*, editorial Limusa, 2000.

Internet Links