NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
COMPUTER SCIENCE PROGRAM

BMA02 – INTEGRAL CALCULUS

I. GENERAL INFORMATION

CODE	**:**	BMA02 Integral Calculus
SEMESTER	**:**	2
CREDITS	**:**	5
HOURS PER WEEK	**:**	6 (Theory – Practice)
PREREQUISITES	**:**	BMA01 Differential Calculus
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course prepares students in the understanding and application of one-dimensional calculus for analyzing and solving engineering problems. Students understand the concepts of anti-derivative, indefinite and definite integrals and their applications for computing areas and volumes. Students also analyze the polar representation of real functions and use them to solve diverse problems. The course focus on both, clear understanding of concepts and correct application of methods for solving engineering problems.

III. COURSE OUTCOMES

1. Identify the scientific character of Mathematics and appraise the rigor and objectivity of the discipline.
2. Recognize the fundamental theorems of Mathematics and apply them into specific and real problematic situations thoroughly.
3. Interpret the concept of indefinite and definite integrals and apply integrations methods to calculate areas and volumes.
4. Apply proper integration methods to compute the integral of a function.
5. Apply the integral concepts into Physics: Work / Inertia moments / Center of mass / Gravity center.
6. Define and apply the polar coordinates into the graphical representations of functions and into the calculus of surface areas.
7. Calculate integral using numeric methods.

IV. COURSE CONTENTS

1. INDEFINITE INTEGRAL. METHODS OF INTEGRATION

Anti-derivative / Indefinite integrals / Immediate integrals / Integration by algebraic substitution / Integration by parts / Integrals of trigonometric functions / Integration by trigonometric substitution / Real function integrations by decomposition into simpler fractions / Integration of rational expressions of trigonometric functions.

2. DEFINITE INTEGRALS

Summations and their properties / Definite integrals: properties / First and second fundamental theorems of calculus / Improper integrals / Improper integrals with non-negative integrands: convergence criteria / Areas of flat surfaces / Volume of a solid of revolution: disc, ring and cylindrical shell methods.

3. TRASCENDENTAL FUNCTIONS

Exponential, logarithm and hyperbolic functions / Logarithms and exponentials in different bases / Derivatives and integrals / Integration of trigonometric functions and their inverses /

4. INTEGRATION TECHNIQUES

Integration of powers series of trigonometric functions / Integration of rational functions by partial fractions / Integration of sine and cosine rational functions / Integration of non-rational functions / Integration of binomial differentials / Integration by substitution.

5. NON-PROPER INTEGRALS

Non-proper integrals of first and second type / Convergence and divergence criteria of non-proper integrals / Gamma function / Beta function / Introduction to first order differential equations / Formulation of problems with differential equations / Separable variables differential equations.

6. APPLICATION OF DEFINITE INTEGRAL

Arc length in rectangular coordinates / Work / Inertia moments / Center of mass / Center of gravity / Quadratic surfaces / Polar coordinates / Graphical representations in polar coordinates / Areas in polar coordinates.

7. NUMERIC INTEGRATION

Approximation of integrals / Trapeze method / Prism method / Simpson method / Power series: Taylor series, McLaurin series / Approximation of integrals through power series.

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. **LARSON – HOSTETLER**
   Differential and Integral Calculus
   Mc Graw Hill, Ed., 2012, Mexico
2. **ROSS L. FINNERY**
   Single Variable Calculus
   Prentice - Hall, Ed., 2010, Mexico