National University of Engineering (UNI)
School of Computer Science
Syllabus 2026-I

1. COURSE

MA103FCCS. Integral Calculus (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	MA103FCCS. Integral Calculus
2.2 Semester	:	2^{nd} Semester
2.3 Credits	:	5
2.4 Horas	:	4 HT; 2 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	:	MA102FCCS. Differential Calculus. (1^{st} Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Integral calculus is essential in computer science for modeling and solving problems involving accumulation, change, and areas under curves. This course provides the foundations of integral calculus, including integration techniques, applications, and its relationship with differential calculus.

5. GOALS

- Understand the concept of definite and indefinite integrals.
- Apply various integration techniques to solve problems.
- Use integral calculus to model and solve problems in scientific and engineering contexts, including applications in computing.

6. COMPETENCES

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

AG-C08) Problem Analysis: Identifies, formulates, and analyzes complex computing problems. (Usage)

6) Apply computer science theory and software development fundamentals to produce computing-based solutions. (Familiarity)

AG-C12) Applies computer science theory and software development fundamentals to produce computer-based solutions. (Familiarity)

AG-C11) Tool Usage: Applies modern computing tools in problem-solving. (Familiarity)

7. TOPICS

Unit 1: The Indefinite Integral (6 hours)	
Competences Expected: 1,6	
Topics	**Learning Outcomes**
• Antiderivatives and the indefinite integral. • Basic integration rules. • Integration by substitution.	• Calculate antiderivatives of basic functions. [Familiarizarse (*Familiarity*)] • Apply the basic integration rules. [Usar (*Usage*)] • Solve indefinite integrals using the substitution technique. [Evaluar (*Assessment*)]
Readings : [Ste15], [LE14]	

Unit 2: The Definite Integral (6 hours)	
Competences Expected: 1,6	
Topics	**Learning Outcomes**
• Riemann sums and the definite integral. • The Fundamental Theorem of Calculus. • Calculating areas.	• Approximate definite integrals using Riemann sums. [Familiarizarse (*Familiarity*)] • Apply the Fundamental Theorem of Calculus to evaluate definite integrals. [Usar (*Usage*)] • Calculate areas under curves using definite integrals. [Evaluar (*Assessment*)]
Readings : [Ste15], [LE14]	

Unit 3: Techniques of Integration (12 hours)	
Competences Expected: 1,6	
Topics	**Learning Outcomes**
• Integration by parts. • Integration of trigonometric functions. • Integration by partial fractions. • Improper integrals.	• Apply the technique of integration by parts. [Familiarizarse (*Familiarity*)] • Integrate trigonometric functions using identities and substitution techniques. [Usar (*Usage*)] • Solve integrals using the technique of partial fractions. [Evaluar (*Assessment*)] • Evaluate improper integrals. [Evaluar (*Assessment*)]
Readings : [Ste15], [LE14]	

Unit 4: Applications of the Definite Integral (12 hours)	
Competences Expected: 1,6,AG-C12	
Topics	**Learning Outcomes**
• Calculating areas between curves. • Calculating volumes of solids of revolution. • Arc length. • Work, average value, and centroids.	• Calculate the area between two curves using definite integrals. [Familiarizarse (*Familiarity*)] • Calculate the volume of solids of revolution using different methods. [Usar (*Usage*)] • Calculate the arc length of a curve. [Evaluar (*Assessment*)] • Apply integrals to calculate work, average value, and centroids. [Evaluar (*Assessment*)]
Readings : [Ste15], [LE14]	

Unit 5: Applications in Computing (12 hours)	
Competences Expected: 1,6,AG-C12	
Topics	**Learning Outcomes**
• Algorithm analysis (e.g., calculating time complexity). • Signal and image processing (e.g., integral transforms). • Probability and statistics (e.g., probability density functions).	• Use integrals to analyze the time complexity of algorithms. [Familiarizarse (*Familiarity*)] • Apply integral transforms in signal and image processing. [Usar (*Usage*)] • Use integrals in the context of probability density functions. [Evaluar (*Assessment*)]
Readings : [Ste15]	

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

[LE14] Ron Larson and Bruce H. Edwards. *Calculus*. Cengage Learning, 2014.

[Ste15] James Stewart. *Calculus: Early Transcendentals*. Cengage Learning, 2015.