Peruvian Computing Society (SPC)
School of Computer Science
Sillabus 2021-I

1. COURSE

MA307. Mathematics applied to computing (Mandatory)

2. GENERAL INFORMATION

2.1 Credits	:	4
2.2 Theory Hours	:	2 (Weekly)
2.3 Practice Hours	:	2 (Weekly)
2.4 Duration of the period	:	16 weeks
2.5 Type of course	:	Mandatory
2.6 Modality	:	Face to face
2.7 Prerrequisites	:	• MA101. Math II. (2^{nd} Sem) • CB111. Computational Physics. (5^{th} Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

This course is important because it develops topics of Linear Algebra and Ordinary Differential Equations useful in all areas of computer science where one works with linear systems and dynamic systems.

5. GOALS

- That the student has the mathematical basis for the modeling of linear systems and dynamic systems needed in the area of Computer Graphics and Artificial Intelligence.

6. COMPETENCES

a) An ability to apply knowledge of mathematics, science. (**Familiarity**)

j) Apply the mathematical basis, principles of algorithms and the theory of Computer Science in the modeling and design of computational systems in such a way as to demonstrate understanding of the equilibrium points involved in the chosen option. (**Usage**)

7. SPECIFIC COMPETENCES

a32) Apply linear transformation to solve problems in computer graphics, artificial intelligence, information management, and simulation.

j8) Apply linear transformations and algorithms to solve computational problems

8. TOPICS

Unit 1: (0)	
Competences Expected: C1	
Topics	**Learning Outcomes**
• Vector spaces. • Independence, base and dimension. • Dimensions and orthogonality of the four subspaces. • Approximations by least squares. • Projections • Orthogonal and Gram-Schmidt bases	• Identify spaces generated by linearly independent vectors. [Usage] • Build orthogonal vector arrays. [Usage] • Approximate functions by trigonometric polynomials. [Usage]
Readings : [Str03], [Apó73]	

Unit 2: (0)	
Competences Expected: C20	
Topics	**Learning Outcomes**
• Concept of linear transformation. • Matrix of a linear transformation. • Change of base. • Diagonalization and pseudo-inversion	• Determining the core and image of a transformation. [Usage] • Building the matrix of a transformation. [Usage] • Determine the base change matrix. [Usage]
Readings : [Str03], [Apó73]	

Unit 3: (0)	
Competences Expected: C24	
Topics	**Learning Outcomes**
• Diagonalization of a matrix. • Symmetrical matrices. • Positive defined matrices. • Similar matrices. • The decomposition of singular value.	• Finding the diagonal representation of a matrix. [Usage] • Determining similarity between matrices. [Usage] • Reducing a real quadratic shape to a diagonal. [Usage]
Readings : [Str03], [Apó73]	

Unit 4: (0)	
Competences Expected: C1	
Topics	**Learning Outcomes**
• Exponential of a matrix. • Theorems of existence and uniqueness for homogeneous linear systems with constant coefficients. • Non-homogeneous linear systems with constant coefficients.	• Finding the overall solution for a non-homogeneous linear system. [Usage] • Solving problems involving systems of differential equations. [Usage]
Readings : [Zil02], [Apó73]	

Unit 5: (0)	
Competences Expected: C20	
Topics	**Learning Outcomes**
• Dynamic systems. • The fundamental theorem. • Existence and uniqueness. • The flow of a differential equation.	• Discuss the existence and uniqueness of a differential equation. [Usage] • Analyze the continuity of solutions. [Usage] • Study the prolongation of a solution. [Usage]
Readings : [HS74]	

Unit 6: (0)	
Competences Expected: C24	
Topics	**Learning Outcomes**
• Stability. • Liapunov features. • Gradient systems.	• Analyze the stability of a solution. [Usage] • Finding Liapunov's function for balance points. [Usage] • Drawing the phase portrait a gradient flow. [Usage]
Readings : [Zil02], [HS74]	

9. WORKPLAN

9.1 Methodology

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

9.2 Theory Sessions

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

9.3 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.

10. EVALUATION SYSTEM

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

11. BASIC BIBLIOGRAPHY

[Apó73] Tom M Apóstol. *Calculus Vol II*. Editorial Reverté, 1973.

[HS74] Morris W. Hirsh and Stephen Smale. *Differential Equatons, Dynamical Systems, and Linear Álgebra*. Academia Press, 1974.

[Str03] Gilbert Strang. *Introduction to Linear Algebra, 3ª edición*. Wellesley-Cambridge Press, 2003.

[Zil02] Dennis G. Zill. *Ecuaciones Diferenciales con Problemas de Valores en la Frontera*. Thomson Learning, 2002. ISBN: 970-686-133-5.