Last update: 16-09-2019

804221 - MAT1VJ - Mathematics

Coordinating unit: 804 - CITM - Image Processing and Multimedia Technology Centre

Teaching unit:

Academic year: 2019

Degree: BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Gutiérrez Antuñano, Miguel Ángel

Others: Sánchez Corrales, Helem Sabina

Prior skills

Algebra, Geometry, and Trigonometry or Precalculus

Requirements

Basic Algebra (factoring, solving for y), Euclidean Geometry, Trigonometric Functions (Sine, Cosine, Tangent) and Identities

Degree competences to which the subject contributes

Generical:

4. (ENG) Interpretar i dominar els conceptes bàsics de matemàtica discreta, lògica, algorísmica i complexitat computacional, i la seva aplicació per al tractament automàtic de la informació per mitjà de sistemes computacionals i la seva aplicació per a la resolució de problemes propis de l'enginyeria.
5. (ENG) Resoldre els problemes matemàtics que puguin plantejar-se en l'enginyeria. Aplicar els coneixements sobre: àlgebra lineal; geometria; càlcul diferencial i integral; mètodes numèrics; estadística.

Transversal:

1. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Teaching methodology

The weekly lectures consist in 4 hours (2 sessions of 2 h each).
During the sessions:
- Theory lectures (new concepts and basic tools, with application examples)
- In-class tutorials

Activities schedule may change, depending on the difficulty of the exercies and the corresponding contents. The supporting material to be used will be available at he virtual campus site.

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Learning objectives of the subject

At the end of the course the student should be able to:
- Apply logical reasoning and mathematical tools within relevant contexts, as well as display proficiency with the covered software.
- Make conversions between number systems and basic operations of matrix calculus.
- Solving basic problems of mathematical analysis in a variable for differentiable functions and / or integrated into a dimension with both analytical and numerical means.
- Graphic the main elementary functions.
- Understand the basics of optimization and solve basic problems.
- Carry out tasks on time, working with information sources, according to the guidelines set by lecturers.
- Carry out autonomous learning.
- Work in groups.
- Access and utilize the mileu of resourses that exist within electronic databases or on campus.

Study load

Total learning time: 150h	Hours large group:	34h	22.67%
	Hours medium group:	16h	10.67%
	Hours small group:	0h	0.00%
	Guided activities:	10h	6.67%
	Self study:	90h	60.00%

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Content

1. Algebra

Learning time: 10h
Practical classes: 4h
Self study : 6h

Description:
Introduction to numerical systems and Boolean algebra
- Numbers and representation
- Boolean Algebra

Related activities:
Lectures and tutorial exercises

2. Trigonometry

Learning time: 15h
Practical classes: 6h
Self study : 9h

Description:
Description of relations of length and angles in a triangle and main trigonometric functions
- Fundamentals of trigonometry: degrees, radians, pi number and Pythagoras Theorem.
- The unit circle and trigonometric functions
- Trigonometric identities, double/half angle formula and basic relations.

3. Vectors and matrices

Learning time: 25h
Practical classes: 10h
Self study : 15h

Description:
Vectorial and matricial calculus
- Scalar, vectors in 2D and 3D.
- Vector magnitude and basic operations.
- Dot product and cross product.
- Matrices, basic operations and properties.
- Determinant of matrix.
- Transposed, adjugate and inverse matrix.
- Applications: rotations, systems of equations and Rouché-Frobenius Theorem.

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4. Functions

Learning time: 40h

Practical classes: 16h
Self study : 24h

Description:
Description of functions:
- Domain, rank and inverse. Basic functions and representation. Types of functions.
- Definition of limit and continuity.
- Intervals of increase/decrease, concavity/convexity. Turning points.
- Bolzano theorem.

5. Analytical geometry 2D and 3D

Learning time: 20h

Practical classes: 8h
Self study : 12h

Description:
Description of the spatial relation between geometrical elements
- Definition of lines, circles and planes in the space.
- Relative positions.
- Curve description

6. Differential calculus

Learning time: 30h

Practical classes: 12h
Self study : 18h

Description:
Description and application of derivatives and integration methods
- Derivative definition.
- Standard derivatives, composition and high order derivatives.
- Application: gradient, tangent, normal, maxima/minima.
- Integration definitions
- Indefinite and definite integrals.
- Integration methods.
- Taylor series.

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7. Statistics and probability	Learning time: 10h Practical classes: 4h Self study : 6h

Description:
Basic concepts on statistical and probabilistic analysis
- Basic statistics
- Probability and combinatorial.

Planning of activities

Exercises and problems	Hours: 30h Theory classes: 12h Self study: 18h

Description:
Practice classroom with exercises and problems resolution

Specific objectives:
Solve mathematical problems that may arise in engineering. Apply knowledge about: algebra, geometry, differential and integral calculus, numerical methods and statistics.

Qualification system

Subject qualification follows a continued evaluation system. There will be two written tests during the course (Partial I and Partial II), five (5) tutorial exercises to be submitted within the corresponding deadline, and a final exam.
The weights of each part are the following:

Partial Exam I 20 %
Partial Exam II 20 %
Final Exam 30 %
Tutorial Exercices (5) 20 %
Participation 10 %

The pass degree is obtained on getting at least a mark of 5 in the final evaluation, computed by considering the weights detailed above. Miss-submitting an exam or tutorial exercise results on a null mark for that deliverable. A

If the pass mark is not obtained, there is the possibility of a reevaluation exam. The qualification of this exam will substitute those of the partial and final exams. The maximum mark to be obtained in the reevaluation is 5.

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Regulations for carrying out activities

In- class exercices:
during the theory lectures, student will develope exercices to be discussed and solved in the same lecture. These exercices act as training to develope the Tutorial Exercices (individual).

Tutorial Exercices (TE):
At the beginning of each package, the corresponding tutorial exercices (TE) will be delivered, and should be submitted within the indicated deadline, in pdf format.Complementary material (Excel, Matlab, Phyton), if convenient, should be submitted as well.

Bibliography

Basic:

Grau, M.; Noguera, M. Cálculo numérico [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 19/12/2016]. Available on: <http://hdl.handle.net/2099.3/36159>. ISBN 8483014556.

Amer Ramon, Rafel. Àlgebra lineal: problemes, exercicis i qüestions. Terrassa: Universitat Politècnica de Catalunya, 1998.

Marsden, J.E.; Weinstein, A. Calculus, vol. 1. 2nd ed. New York: Springer-Verlag, 1985. ISBN 0387909745.

García López, Alfonsa. Cálculo I : teoría y problemas de análisis matemático en una variable. 2ª ed. Madrid: Clagsa, 1994. ISBN 8460509443.

Complementary:

Lubary, J.A.; Brunat, J.M. Cálculo para ingeniería informática. Barcelona: Edicions UPC, 2008. ISBN 9788483019597.

Lang, S. A first course in calculus. 5th ed. New York: Springer, 1998. ISBN 9780387962016.

Others resources: