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3200011 - M1 - Mathematical Methods I

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2019

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: JOSEP GIBERGANS BAGUENA

Others: Puerta Coll, Xavier
Pujol Vazquez, Gisela
Sabater Pruna, Assumpta

Prior skills

Is highly desirable to have completed mathematics courses provided in the curriculum of the different types of secondary education giving access to degree studies.

Evaluations consist of acts of classroom evaluation and / or other evaluation activities as part of continuous assessment. If you do not perform any of the acts or activities shall be considered qualified to zero.

Degree competences to which the subject contributes

Specific:

3. (ENG) Capacitat per a la resolució dels problemes matemàtics que puguin platenjar-se a l'enginyeria. Aptitud per aplicar els coneixements sobre: àlgebra lineal; geometria, geometria diferencial; càlcul diferencial i integral; equacions diferencials i amb derivades parcials; mètodes numèrics; algorítmica numèrica; estadística i optimització.

Transversal:

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

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Teaching methodology

- Lectures presenting content.
- Face-to-face sessions of practical work.
- Independent work study and conducting exercises.
- Preparation and implementation of individual and / or group activities.

In the sessions of explanatory content teacher introduce the theoretical foundations of the subject, concepts, methods and illustrated with suitable examples to facilitate understanding results. The students will independently study to assimilate the concepts, solve exercises either manually or with the help of computer.

Students will become familiar in the use of a mathematical software package in order to use it as a tool for numerical, symbolic and graphic calculation.

Learning objectives of the subject

Students will have to consolidate the fundamental concepts of differential and integral calculus. They will also have to know and understand the concepts and results of linear algebra and geometry.

Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	30h	20.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

TOPIC 1: SINGLE-VARIABLE DIFFERENTIAL CALCULUS

Learning time: 45h

Theory classes: 9h
Practical classes: 9h
Self study : 27h

Description:

1.1. Derivative of a function at a point. Geometric interpretation of the derivative. The derivative function. Chain rule. Implicit differentiation. Differential of a function. Theorems.
1.2. Extrema. Optimization.
1.3. Taylor polynomial. Linear approximation.

Specific objectives:

- Understand the concept of continuous and derivable functions.
- Correctly interpret the meaning of a derivative.
- correctly apply the concepts of linear approximation and Taylor polynomial approximation.
- Correctly carry out basic operations and use the technique of optimisation.

TOPIC 2: INTEGRAL CALCULUS

Learning time: 35h

Theory classes: 7h
Practical classes: 7h
Self study : 21h

Description:

2.1. Definite integration.
2.2. Indefinite integration. Methods: change of variable and integration by parts.
2.3. Applications of definite integral.
2.4. Improper integrals.

Specific objectives:

For students to:

- Understand the concept of a Riemann definite integral, the fundamental theorem of calculus, and Barrow's rule.
- Carry out indefinite integration, quasi-indefinite integration and integration by parts.
- Apply the definite integral to find areas, moments of inertia, volumes, etc..
- Understand the concept of improper integral and the techniques for calculating them.

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TOPIC 3: COMPLEX NUMBERS	Learning time: 10h Theory classes: 2h Practical classes: 2h Self study : 6h

Description:
3.1. The concept of complex numbers.
3.2. Graphical representation.
3.3. Binomial, polar and trigonometric forms.
3.4. Operations with complex numbers.
1.5. Euler's formula.
1.6. Exponentiation. De Moivre's formula.
1.7. N-th root of a complex number.

Specific objectives:
- Understand the concept and representations of complex numbers and basic operations with complex numbers.

TOPIC 4: LINEAR ALGEBRA: VECTOR SPACES AND DIAGONALISATION	Learning time: 60h Theory classes: 12h Practical classes: 12h Self study : 36h

Description:
4.1. Vector spaces. Subspaces of Rn:
- Vector subspaces. Generated subspaces.
- Linear independence. Bases.
- Change of basis.

4.2. Linear transformations:
- Transformation matrices.
- Eigenvectors and eigenvalues.
- Diagonalisation.

Specific objectives:
- Understand the specific concepts and techniques applicable to vector spaces, in particular Rn spaces: vector subspaces, the generating set of a subspace, linear dependence and independence, bases.
- Understand the change of basis technique.
- Understand the concept of linear transformation and its matrix representation.
- Calculate the eigenvalues and eigenvectors of a matrix and understand the diagonalisation technique.

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Planning of activities

ACTIVITY 1: COMPUTER-ASSISTED WORK	Hours: 10h Self study: 10h

ACTIVITY 2: COMPUTER-ASSISTED WORK	Hours: 10h Self study: 10h

ACTIVITAT 3: EXAMS	Hours: 8h Theory classes: 8h

Qualification system

The evaluation of the course will be partial evaluations by the following weights:
- Midterm exams: 70% (First exam: 25%, Segond exam: 45%)
- Tasks: 30%

Regulations for carrying out activities

The evaluations consist of the partial exams and other evaluable activities that are part of the continuous evaluation. If any of the exams or activities are not carried out, it will be considered qualified with zero.

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Bibliography

Basic:

García Pineda, Pilar; Núñez del Prado, José Antonio; Sebastián Gómez, Alberto. Iniciación a la matemática universitaria: curso 0 de matemáticas. Madrid: Thomson, cop. 2007. ISBN 9788497324793.

Larson, R.E.; Hostetler, R.P.; Edwards, B.H. Cálculo. 8ª ed. Madrid: Mc Graw-Hill, 2006. ISBN 970-10-5710-4.

Lay, David C; McDonald, Judi J; Lay, Steven R. Algebra lineal y sus aplicaciones. 5a ed. México: Pearson educación, 2016. ISBN 9786073237451.

Burgos Román, Juan de. Algebra lineal y geometría cartesiana. 3a ed. Madrid [etc.]: McGraw-Hill, cop. 2006. ISBN 8448149009.

Tomeo Perucha, Venancio; Uña Juárez, Isaías; San Martín Moreno, Jesús. Problemas resueltos de cálculo en una variable. Madrid: Thomson, 2005. ISBN 8497322894.

Rogawski, Jon. Cálculo. 2a ed. original. Barcelona: Reverté, cop. 2012. ISBN 9788429151664.

Piskunov, N. Cálculo diferencial e integral. México: Limusa, 1994. ISBN 9681839854.

Complementary:

Gibergans Bàguena, Jose; Pujol Vázquez, Gisela; Buenestado Caballero, Pablo; García Ciaurri, Fernando. Matemáticas para la ingeniería con Maple. Barcelona: Edicions UPC, 2008. ISBN 9788483019672.

Others resources:

- Exercices
- Basic Maple tutorials