

Course guide

330212 - MBE - Basic Engineering Mathematics

Last modified: 05/09/2023

Unit in charge:	Manresa School of Engineering		
Teaching unit:	749 - MAT - Department of Mathematics.		
Degree:	BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Compulsory subject).		
Academic year: 2023	ECTS Credits: 6.0	Languages: Catalan	

LECTURER

Coordinating lecturer:	Rossell Garriga, Josep Maria
Others:	MONTSERRAT ALSINA AUBACH - JOSEP M. CORS IGLESIAS - MARGARITA DOMENECH BLAZQUEZ - JOSEP FREIXAS BOSCH - JOSE MIGUEL GIMENEZ PRADALES - M. ALBINA PUENTE DEL CAMPO - JOSEP RUBIÓ MASSEGÚ - ENRIC VENTURA CAPELL

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE1: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

Face-to-face sessions in a large group in which the professor explains the foundations of each topic, gives examples and sets the students exercises or tasks.

Independent study sessions in which students study the professor's explanations, look at them in depth with the help of the textbook and do the exercises or tasks proposed.

Face-to-face sessions in a small group in which the professor answers students' queries after their independent study and/or students carry out practicals.

LEARNING OBJECTIVES OF THE SUBJECT

On completion of the subject Basic Engineering Mathematics, students must be able to:

- Solve linear algebra and single variable calculus problems with the support of Maple software without difficulties.
- Think in increasingly abstract terms.
- Understand and apply deductive reasoning.
- Organise and apply theoretical knowledge to solve concrete problems.
- Interpret the results obtained with the help of computer tools.



STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours small group	30,0	20.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. SINGLE VARIABLE DIFFERENTIAL CALCULUS

Description:

Basic functions in engineering.
Differentiation and applications of the derivative.
Linear approximation.
Relative and absolute extrema.
Zeros of functions: bisection and Newton-Raphson methods.

Related activities:

Activities A1, A2 and P1

Full-or-part-time: 47h

Theory classes: 10h
Laboratory classes: 10h
Self study : 27h

2. SINGLE VARIABLE INTEGRAL CALCULUS

Description:

Area between curves. Definite integrals: Barrow's rule
Indefinite integrals
Integration techniques: direct integration, by substitution, by parts and rational functions.
Improper integrals
Numerical integration: trapezoidal rule and Simpson's rule

Related activities:

Activities A2 and P1

Full-or-part-time: 37h

Theory classes: 8h
Laboratory classes: 8h
Self study : 21h

3. LINEAR SYSTEMS, MATRICES AND DETERMINANTS

Description:

Calculation of matrices and determinants
Systems of linear equations
Gauss method: numerical solution
Least squares curve fitting

Related activities:

Activities A2 and P2

Full-or-part-time: 30h

Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

4. LINEAR ALGEBRA

Description:

R^n spaces
Vector subspaces generated by a set of vectors
Basis, dimension
Change of basis
Eigenvalues and eigenvectors
Diagonalisation

Related activities:

Activities A2 and P2

Full-or-part-time: 30h

Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

5. COMPLEX NUMBERS

Description:

Basic knowledge of complex numbers.

Specific objectives:

Students can learn this topic on their own, based on notes and questionnaires that are made available to them.

Related activities:

P1

Full-or-part-time: 6h

Self study : 6h

GRADING SYSTEM

The mark NC is calculated from the marks corresponding to activities A1, A2, P1 i P2 in the following way: $NC = 0,4 \cdot P1 + 0,4 \cdot P2 + 0,1 \cdot (A1 + A2)$

The learning objectives are considered to have been met if the final mark for continuous assessment NC is greater than or equal to 5. Students with a mark for the subject NC of less than 5 may take a final examination (mark: NF).

The student's final mark ND will be $ND = \max(NC, NF)$.

EXAMINATION RULES.

All the activities are compulsory.

If students do not carry out one of the activities for the subject they will be given a mark of 0.

BIBLIOGRAPHY

Basic:

- Yasskin, Philip B. CalcLabs with Maple for Stewart's single variable calculus. 5th ed. [Toronto, Ontario]: Thomson. Brooks/Cole, cop. 2003. ISBN 0534393705.
- Stewart, James. Cálculo de una variable: trascendentes tempranas. 6ª ed. México: International Thomson, 2008. ISBN 9789706866530.
- Benavent, Roberto. Cuestiones sobre álgebra lineal. Madrid: Paraninfo, 2010. ISBN 9788428380973.
- Lay, David C. Álgebra lineal y sus aplicaciones [on line]. 5ª ed. México: Pearson Educación, 2016 [Consultation: 07/06/2022]. Available on : https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6765. ISBN 9786073237451.
- Nakos, George; Joyner, David. Álgebra lineal con aplicaciones. México: Thomson, 1999. ISBN 9687529865.
- Larson, Ron; Hostetler, Robert P.; Edwards, Bruce H. Cálculo y geometría analítica. Vol. 1. 6ª ed. Madrid: McGraw-Hill, 1999. ISBN 8448122291.
- Smith, Robert T.; Minton, Roland B.; Rafhi, Ziad A. T. Cálculo de una variable: trascendentes tempranas [on line]. 5a. McGraw Hill, 2019 [Consultation: 13/02/2023]. Available on : https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8726. ISBN 9781456272340.