

SUBJECT TEACHING GUIDE

G585 - BROAD MATHEMATICS

Degree in Energy Resources Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Degree in Energy Resources Engineering			Type and Year	Compulsory. Year 2
Faculty					
Discipline	Subject Area: Advanced Basic Training Module: Training in Common with the Mining Branch				
Course unit title and code	G585 - BROAD MATHEMATICS				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION				
Name of lecturer	JOAQUIN BEDIA JIMENEZ				
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Other lecturers	FABIO PIZZICHILLO				

3.1 LEARNING OUTCOMES

- Critically analyse the characteristics of a population from a sample. Apply the fundamental properties of the punctual estimators and confidence intervals.
- Manage the concept of multiple integral of Riemann and its application to problems of Physics and Engineering. Use symbolic calculus software to solve problems of calculation of volumes, areas, centers of gravity.
- Apply the Fourier analysis and express a function by a series of trigonometric functions.
- Classify and solve some types of first-order differential equations.
- Solve differential equations of second order, linear and constant coefficients, homogeneous and not homogeneous. Application of the Laplace transform.
- Know some second order partial differential equations.
- Use of specific software for the resolution of different problems.
- To analyse the importance of quality control and the quality control programmes
- To use symbolic calculus software to solve calculus problems about volume, area and gravity center

4. OBJECTIVES

- Familiarize the students in the required statistical tools to apply inference studies from a sample.
- Introduce students to statistical quality control and its applications.
- Know how to sketch curves, surfaces and volumes, in three-dimensional space, defined by implicit or parametric equations, in rectangular, polar or cylindrical coordinates.
- Know how to express a curve as a vector function of a variable and calculate its length from its differential.
- Learn to calculate curvilinear integrals, double and triple integrals of curves, surfaces and volumes, respectively, in order to obtain geometric or physical characterizations. Example: calculation of work of a force, mass of a rod, areas, volumes, geometric center and center of mass.
- Know the theory and applications of Fourier Analysis.
- Learn to solve simple differential equations of first and second order by analytical and numerical methods.
- Know the modeling through differential equations of different processes in physics, engineering, economics, biology. Solve these equations and represent and analyze the solution.
- Know some equation in partial derivatives of second order.
- Deepening into the use of specific software as a basic tool for calculus and statistical analysis.

6. COURSE ORGANIZATION

CONTENTS	
1	Part I: Confidence intervals and statistical quality control Theme 1: Inference and hypothesis testing Theme 3: Linear regression Theme 3: Statistical quality control
2	Part II: Integral calculus Theme 3. Curves and surfaces Theme 4. Double and triple integrals Theme 5. Theory of vector fields
3	Part III: Fourier series, Fourier transform Theme 6 Fourier series, Fourier transform, applications
4	Part IV: Differential equations. Theme 7. First order differential equations Theme 8. Second order ordinary differential equations Theme 9. Numerical resolution of initial value problems Theme 10. Introduction to partial differential equations

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Computer Lab sessions	Laboratory evaluation	No	No	16,00
Continuous evaluation tests	Written exam	No	Yes	24,00
Written exam 1	Written exam	Yes	Yes	30,00
Written exam 2	Written exam	Yes	Yes	30,00
TOTAL				100,00
Observations				
<p>In the case of not exceeding the minimum grades, the global numerical grade will be the lowest value between 4.9 and the weighted average of all the evaluation items, as indicated in the Regulation of the UC Evaluation Processes, article 35. Only for duly justified causes (e.g. health restrictions) the evaluation tests may be organized remotely, with prior authorization from the Faculty's Board.</p>				
Observations for part-time students				
<p>Part-time students may carry out the laboratory practices individually at a convenient time, on request at the beginning of the semester. The part of the grade corresponding to continuous assessment tests ('Controls'), may be carried out jointly in the ordinary call (final exam).</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Luceño, A.; González, F.J. 2004. "Métodos estadísticos para medir, describir y controlar la variabilidad". Santander : Servicio de Publicaciones de la Universidad de Cantabria. ISBN: 84-8102-375-2.
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Marsden, J.E.; Tromba, A.J. 1998. "Cálculo Vectorial". Wilmington, Delaware: Addison-Wesley Iberoamericana. ISBN: 0-201-04604-0
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Larson, R.; Hostetler, R.P.; Edwards, B.H. 2006. "Cálculo". México: McGraw-Hill. ISBN: 970-10-5274-9
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Simmons, G.F.; Robertson, J.S. 1993. "Ecuaciones diferenciales: con aplicaciones y notas históricas". McGraw-Hill. ISBN: 84-481-0045-X
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O'Neil PV. 1994. "Matemáticas avanzadas para la Ingeniería". 3ª Edición. Cecsca