Calculus III

Academic Year: (2023 / 2024) **Review date: 07/06/2023 14:56:04**

Department assigned to the subject: Mathematics Department

Coordinating teacher: CASTILLO RIVERA, SALVADOR

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I,
Calculus II,
Linear Algebra.

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Analyze, formulate and solve problems with initiative, decision-making, creativity,critical reasoning skills and ability to efficiently communicate and transmit knowledge, skills and abilities in the Energy Engineering field
CG2. Apply computational and experimental tools for analysis and quantification of energy engineering problems
CG10. Being able to work in a multi-lingual and multidisciplinary environment
CE1 Módulo FB. Ability to solve the mathematic problems arising in engineering. Aptitude for applying knowledge on: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives in differential equations; numerical methods; numerical algorithms; statistics and optimization.
CT1. Ability to communicate knowledge orally as well as in writing to a specialized and non-specialized public.
CT2. Ability to establish good interpersonal communication and to work in multidisciplinary and international teams.
CT3. Ability to organize and plan work, making appropriate decisions based on available information, gathering and interpreting relevant data to make sound judgement within the study area.
CT4. Motivation and ability to commit to lifelong autonomous learning to enable graduates to adapt to any new situation.

By the end of this content area, students will be able to have:
RA1.1 knowledge and understanding of the mathematical principles underlying the branch of energy engineering.
RA2.1 the ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods.
RA2.3 the ability to select and apply relevant analytic and modelling methods.
RA5.1 the ability to select and use appropriate tools and methods.
RA5.2 the ability to combine theory and practice to solve engineering problems.

RA5.3 an understanding of applicable techniques and methods, and of their limitations.

OBJECTIVES

By the end of this course, students will be able to:

1. Know and understand the mathematical principles of the Theory of Differential Equations, both Ordinary and in Partial Derivatives, underlying Energy Engineering.

2. Apply their knowledge and understanding of the mathematical principles to identify, formulate and solve problems in Differential Equations by using established methods.

3. Combine theory and practice to solve Differential Equations problems.

4. Know and understand the methods and procedures of the Theory of Differential Equations, its area of application and its limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

1. First Order Differential Equations.
   a. Definitions and examples.
   b. Elementary resolution methods.
   c. Applications.

2. Higher Order Linear Differential Equations.
   a. Linear equations of order n with constant coefficients.
   b. Equations with variable coefficientes: undetermined coefficients and variation of constants

3. Laplace Transform.
   a. Definition and properties.
   b. Transforming and anti-transforming.
   c. Application to solving linear differential equations and systems.

4. Introduction to Partial Differential Equations.
   a. Initial and boundary problems.
   b. Examples of PDEs of Mathematical Physics.
   c. Different kind of equations and data.
   d. Classification of second order, linear PDEs.

5. Method of separation of variables.
   a. Even, odd, and periodic extensiones of a function. Trigonometric Fourier series.
   b. Solving homogeneous and non-homogeneous PDEs using separation of variables and Fourier series.

6. Sturm-Liouville Problems.
   a. Self-adjoint Sturm-Liouville problems.
   b. Rayleigh's quotient. Minimization theorem.
   c. Solving PDEs using separation of variables and generalized Fourier series.

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology consists of:

-lectures covering the most important topics defined in the course programe.

-Participation at class solving proposed problems in group or individually on the blackboard.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

1. Control exams.
2. Final exam.

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BASIC BIBLIOGRAPHY

- G.F. SIMMONS, S.G. KRANTZ Differential Equations, Theory, Technique and Practice, McGraw-Hill Companies Inc., 2007

- R. HABERMAN Elementary Applied Partial Differential Equations, Prentice Hall, 3rd. edition, 1998

ADDITIONAL BIBLIOGRAPHY

- C.H.EDWARDS Jr., D.E. PENNEY Ecuaciones Diferenciales Elementales y Problemas con Condiciones en la Frontera, 3ª edición, Prentice-Hall, 1993

- D.G. ZILL. Ecuaciones Diferenciales con Aplicaciones de Modelado,, Thomson, sexta edición, 1997

- G.F. SIMMONS Ecuaciones Diferenciales con Aplicaciones y Notas Históricas, McGraw-Hill, 1993

- J.R. BRANNAN, W.E. BOYCE Differential Equations with Boundary Value Problems: An Introduction to Methods and Applications, Wiley, 2010

- R.K. NAGLE, R. KENT, E.B. SAFF, A.D. SNIDER Fundamentals of Differential Equations, Pearson Addison-Wesley, 7th ed. 2008

- W.E. BOYCE, R.C. DI PRIMA. Ecuaciones Diferenciales y Problemas con Valores en la Frontera. , Limusa, 1998