Curriculum - Academic Year 2018-19
Characteristics of the Course Units

Name	*Applied Numerical Methods*
ECTS credits	*4*
Year / Semester	*I /2°*
Specific learning outcomes	*On successful completion of this module students should be able to:* *1-Knowledge of basic theorems and concepts in the different areas of mathematics* *2-Ability to consider problems that could be solved by implementing concepts from different areas in mathematics* *3-Efficient use of computers, laboratories and softwares to handle problems that are difficult to be solved manually* *4-Understanding of professional and ethical responsibilities* *5- Efficient use of the techniques, skills, and tools of modern mathematics* *6 – Participate in class discussions with colleagues and with teachers*
Contents	*- Numerical Methods for Ordinary Differential Equations (Euler method;Method of Taylor series; Predictor-corrector method;Runge kutta method)* *- Numerical Methods for partial Differential Equations:* *a. Classification of Partial Differential Equations* *b. Finite difference methods:Solution of Partial Differential Equations of the Parabolic Type with; Explicit scheme; Implicit scheme; Crank-Nickolson Scheme;Solution of elliptic differential equations.* *c. Solution of Partial Differential Equations by Finite Element Method: Choice of a mesh; Discretization of the differential equation with the boundary conditions; Assembly of elementary matrices; Digital resolution of the system of global equations.*
Teaching and learning methods	*Face to face, 72 hours*
Teaching techniques	*Lectures, 24 hours* *Practical classes, 48 hours*
Assessment methods	*Written and practical.* *Consulting with lecturer during office hours.* *Consulting with teaching assistant during office hours.* *Private sessions for redelivering the lecture contents.*
Assessment criteria	*In the mid-term test students should demonstrate their ability to identify:* *1) Knowledge and Understanding: Students are able to understand the nature and operations of Numerical Analysis, demonstrate familiarity with theories and concepts used in Numerical Analysis and identify the steps required to carry out a piece of research on a topic in Numerical Analysis, derivation of the Numerical Methods, studying their convergence rate and performance, applicability of the methods on different test examples.* *2) Intellectual Skills: By the end of the course the student is expected to solve real-life and Engineering applications reflecting the student ability to: Recognize and apply appropriate theories, principles and concepts relevant to Numerical Analysis.* *B2 Critically assess and evaluate the literature within the field of Numerical Analysis. B3 Analyze and interpret information from a variety of sources relevant to Numerical Analysis.* *2) Practical Skills: By the end of the course student will have the ability to compare the computational methods for advantages and drawback, choose the suitable computational method among several existing methods , implement the*

	computational methods using any of existing programming languages, test such methods and compare between them, identify the suitable computational technique for a specific type of problems and develop the computational method that is suitable for the underlying problem. *3) Transferable Skills: Within the lectures the student is able to transfer ideas and experience Numerical Analysis Techniques, work effectively both in a team and independently, apply the best computational methods to solve real-life and Engineering applications via computational packages such as MATLAB or Mathematica and develop his ability to self appraise and reflect on practice relevant to Numerical Analysis* *Finally, students' ability to participate in class discussions with teachers and colleagues will be assessed in practical classes.*
Assessment metrics	*Attribution of a final grade*
Criteria of attribution of the final grade	*The grade goes from 1 (minimum) up to 10 (maximum). The minimum threshold to pass is 6. To pass the exam students should obtain the minimum evaluation in all the assessments.* *The final grade will be determined according to the following rules:* *Midterm Evaluation: (30%)* *Final exam: (40%)* *practical classes assessments: (30%)*
Preparatory course units	*N.A.*
Didactic material	*Aslak Tveito, Ragnar Winther Introduction to Partial Differential Equations_ A Computational Approach 2008* *A First Course in the Numerical Analysis of Differential Equations, Cambridge University Press, 2008 .* *Franck Jedrzejewski Introduction aux methodes numeriques 2005* *Roland Glowinski, Pekka Neittaanmaki Partial Differential Equations_ Modelling and Numerical Simulation (Computational Methods in Applied Sciences) 2008*