a) General			
School	ENGINEERING		
Academic unit	MECHANICAL ENGINEERING		
Level of studies	Undergraduate		
Course code	MM004Y01	*Semester*	4
Course title	**Numerical methods**		
Independent teaching activities		*Weekly teaching hours*	*ECTS*
Lectures		5	6.5
Laboratory exercises			
Course type	Special background		
Course category	Compulsory		
Prerequisite courses	-		
Language of instruction and examinations	Greek		
Is the course offered to Erasmus students	Yes		
Course website (url)	https://eclass.uniwa.gr/courses/MECH115/		

b) Learning outcomes and general competences

b1. Learning outcomes

Upon successful completion of this course, the student will be able to:

- Recognize and describe the practical engineering applications where the usage of numerical methods and/or numerical software can be helpful to obtain solutions,
- Solve practical mechanical engineering problems with the use of numerical methods,
- Distinguish between various numerical methodologies and apply the most suitable for each case,
- Apply the most suitable numerical procedures to solve each project and to write a complete technical report,
- Evaluate the numerical results arouse in the solution of various practical problems and suggest possible optimal treatment.

b2. General competences

- Search for, analysis and synthesis of data and information with the use of the necessary technology
- Working independently
- Team work
- Working in an international environment

c) Syllabus

Introduction, Measuring Errors, Sources of Error, Floating Point Representation, Machine ε, Errors, Solution of equations system, Direct methods Gauss elimination, Gauss-Jordan and Thomas, LU factorization, Unstable systems, table norms, Recursive methods of Jacobi, Gauss-Seidel, S.O.R.., Comparison of recursive methods and definition of spectral radius, Non-linear systems, Newton's method, Solution of equations, Bisection method, Linear interpolation method, Secant Method, Newton- Raphson Method, Roots of polynomial, Interpolation, Tables of differences and finite differences operators, Newton-Gregory Interpolation, Lagrange Interpolation, Newton Interpolation, Hermite Interpolation, Quadratic and Cubic "splines" Interpolation, Least square method, Integration, Newton Cotes Integration formula, Trapezoidal Rule, Simpson's 1st and 2nd Rules of integration, Richardson method, Romberg Integration, Gauss Integration, ODE Primer, Euler's Method, Runge-Kutta 2nd, Runge-Kutta 4th, Finite

<table>
<tr><td colspan="3">Difference Method, Shooting Method</td></tr>
<tr><td colspan="3">d) Teaching and learning methods - Evaluation</td></tr>
<tr><td>Delivery</td><td colspan="2">Face-to-face and/or Distance learning.</td></tr>
<tr><td>Use of information and communications technology</td><td colspan="2">- Commercial/free/open source software
- Multimedia applications
- MS Teams/ eclass</td></tr>
<tr><td rowspan="7">Teaching methods</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Tutorials</td><td>13</td></tr>
<tr><td>Laboratory exercises</td><td>0</td></tr>
<tr><td>Computational exercises</td><td>26</td></tr>
<tr><td>Individual work</td><td>91</td></tr>
<tr><td>Course total</td><td>169</td></tr>
<tr><td>Student performance evaluation</td><td colspan="2">Intermediate and final exams</td></tr>
<tr><td colspan="3">e) Suggested bibliography</td></tr>
<tr><td colspan="3">1. Σαρρής, Ι.Ε. & Καρακασίδης, Θ. (2017). Αριθμητικές Μέθοδοι και Εφαρμογές για Μηχανικούς. Εκδόσεις Α. Τζιόλα.
2. Carnahan B., Luther H.A. & Wilkes, J.O. (1969). Applied Numerical Methods. J. Wiley & Sons.
3. Chapra, S.C. & Canade, R.P. (1998). Numerical methods for engineers, McGraw Hill.
4. Forsythe, G.E., Malcolm, M.A. & Moler, C.B. (1977). Computer methods for mathematical computations, Prentice-Hall.</td></tr>
</table>