Course Profile

Course Number: **MATH 302**	Course Title: Numerical Methods
Required / Elective : Required	**Pre-requisite:** MATH 200
Catalog Description: Solution of non-linear equations, fixed point iteration; interpolation, Chebyshev polynomials, cubic spline interpolation. Numerical differentiation and integration, solution of system of linear equations: direct and iterative methods. Numerical solution of ordinary differential equations.	**Textbook / Required Material:** K. E. Atkinson, W. Han, *Elementary Numerical Analysis, 3*Ed. John Wiley, 2004.

Course Structure / Schedule: (3+0+0) 3 / 5 ECTS

Extended Description:
Taylor polynomials; Rootfinding: the Bisection method, Newton's method, the Secant method, Fixed point iteration. Interpolation and approximation; Polynomial interpolation, Divided differences, Error in polynomial interpolation. Interpolation using spline functions. Chebyshev polynomials, a near-minimax approximation, Least squares approximation. Numerical integration, the trapezoidal and Simpson rules, error formulas. Gaussian numerical integration method. Numerical differentiation, Differentiation by interpolation, Method of undetermined coefficients.
Systems of linear equations, Gaussian elimination, partial pivoting, LU factorization. Tridiagonal systems, errors in solving linear systems, Iteration methods, Jacobi iteration, Gauss-Seidel iteration. Ordinary differential equations, Euler's method, convergence. Taylor and Runge-Kutta methods for initial value problems.

Design content: None	**Computer usage:** Students use software packages to implement the numerical methods.

Course Outcomes: By the end of the course the students should be able to:

1. solve numerically nonlinear equations in a single variable **[3, 5],**
2. have a basic knowledge of numerical interpolation and approximation of functions **[3, 5],**
3. have a basic knowledge of numerical integration and differentiation **[3, 5, 6],**
4. be familiar with numerical solution of ordinary differential equations **[3, 5, 6].**

[3] demonstrate the ability to apply mathematics to the solutions of problems,

[5] have an ability to write computer programs and use algorithms for solving problems,

[6] have a basic knowledge of the main fields of mathematics, including analysis, algebra, differential equations, differential geometry.

Recommended reading:

D. Kincaid and W. Cheney, *Numerical Analysis: Mathematics and Scientific Computing*, 3E,

Brooks/Cole, 2002.	
Teaching methods:	
Pre-readings, lectures, small projects and individual exercises.	
Assessment methods:	
Projects, midterm exams, final exam	
Student workload:	

	Preparatory reading	40 hrs
	Lectures, workshop, discussions	50 hrs
	Homework	20 hrs
	Projects	12 hrs
	Final Exam	3 hrs
TOTAL ……………………………		**125 hrs … to match 25 x 5 ECTS**

Prepared by: Saadet Erbay	Revision Date: 08.02.2010