HASAN KALYONCU UNIVERSITY
Faculty of Engineering
Course Description Form

COURSE: Numerical Analysis				
CODE: CENG462	**SEMESTER:** FALL OR SPRING			
LANGUAGE: ENGLISH	**TYPE:** ELECTIVE			
PRE-REQUISITES: MATH 151, MATH 152, MATH 251, MATH 252 **CO-REQUISITES:**	**THEORY**	**PRACTICAL**	**CREDIT**	**ECTS**
WEEKLY HOURS:	3	0	3	5

CONTENT OF THE COURSE:
In this course, students will be introduced to the concepts of mathematical procedures and the importance of the algorithm on the numerical calculations. Subunits of the algorithms. Matrix and matrix calculations. Solution methods of the linear equations systems. Solution methods of the nonlinear equations systems. Curve fitting methods, interpolation methods and extrapolation methods. Numerical methods of derivation. Numerical methods of integration. Numerical methods of differentiation equations. Complex numbers.

OBJECTIVE OF THE COURSE:
Aim of this course is to teach numeric solutions methods and algorithms to solve engineering problems by using computer.

WEEKLY SCHEDULE	
Week	**Topics**
1	Introduction to numerical analysis, Error Analysis
2	Numerical method for nonlinear equations: Bisection Method, Newton-Raphson Method
3	Numerical method for nonlinear equations: Secant Method
4	Numerical Differentiation of Continuous Functions (FDD,BDD,CDD)
5	Numerical Differentiation of Continuous Functions (Higher Order Derivative, Accuracy of Divided Difference
6	Numerical method for Simultaneous linear equations using Naïve Gauss elimination
7	Numerical method for Simultaneous linear equations using LU Decomposition
8	**Mid Examination Week**
9	Interpolation: Divided difference method, Direct Method
10	Interpolation: Lagrange interpolation
11	Numerical integration: Trapezoidal Rule
12	Numerical integration: Simpson's 1/3rd Rule
13	Numerical Methods for Ordinary Differential Equations: Euler's Method
14	Numerical Methods for Ordinary Differential Equations: Runge-Kutta 2nd

TEXTBOOK:
Autar K Kaw, "Numerical Methods with Applications", 2nd Edition, 2011.

REFERENCE BOOKS:

- C. F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 2004.
- A. Neumaier, Introduction to Numerical Analysis, Cambridge University Press, 2001.
- Iserles, A First Course in the Numerical Analysis of Differential Equations, Cambridge University Press, 2008

EVALUATION SYSTEM:		
IN-TERM STUDIES	**QUANTITY**	**PERCENTAGE (%)**
Midterm Exam	1	20%
Homework	3	30%
Laboratory works	-	-
Quiz	2	10%
Final Exam	1	40%
TOTAL	**7**	**100%**
CONTRIBUTION OF INTERM STUDIES TO OVERALL GRADE	6	60%
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE	1	40%
TOTAL	**7**	**100%**

COURSE CATEGORY:	**PERCENTAGE (%)**
Mathematics and Basic Sciences	70%
Engineering	30%
Engineering Design	0%
Social Sciences	0%

TABLE OF ECTS / WORKLOAD:			
Activities	**QUANTITY**	**Duration (Hour)**	**Total Workload**
Course Duration	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Laboratory works	-	-	
Mid-term	1	2	2
Final examination	1	2	2
Homework	3	3	9
Quiz	2	0.5	1
Total Work Load			**137**
Total Work Load / 30			**4,57**
ECTS Credit of the Course			**5**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1**	**PO1**

										0	**1**
LO1	3	3	2	1	1	0	1	1	2	2	2
LO2	3	3	3	2	2	1	1	2	1	2	1
LO3	3	3	2	2	2	1	1	1	1	2	1
LO4	3	3	2	2	2	1	0	2	2	2	1
LO5	3	3	2	2	2	1	1	2	1	2	1
	PO: Program Outcomes | LO: Learning Outcomes Values: 0: None | 1: Low | 2: Medium | 3: High										

INSTRUCTOR(S):	Asst. Prof. Dr. Mohammed Madi
FORM PREPARATION DATE:	22.05.2019

LEARNING OUTCOMES OF THE COURSE:	**PROGRAM OUTCOMES:**
LEARNING OUTCOMES OF THE COURSE: **LO1: Describe the need for numerical methods in solving intractable problems in the field of computer engineering.** **LO2: Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to mathematical problems.** **LO3: Apply numerical methods to obtain approximate solutions to mathematical problems.** **LO4: Analyse and evaluate the accuracy of common numerical methods.** **LO5: Derive numerical methods for various mathematical operations and tasks.**	**PO1:** Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems. **PO2:** Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose. **PO3:** Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose. **PO4:** Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively. **PO5:** Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions. **PO6:** Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually. **PO7:** Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions. **PO8:** Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself. **PO9:** Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice. **PO10:** Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship,

	innovation; knowledge about sustainable development. **PO11:** Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.