AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Numerical Solution of Differential and Integral Equations								
Course Code	MTK616		Couse Level		Third Cycle (Doctorate Degree)				
ECTS Credit	7.5	Workload	193 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	To provide a unified account of numerical methods for solving integral, differential and partial differantial equations.								
Course Content	The general approach to finding a solution to a differential equation (or a set of differential equations) is to begin the solution at the value of the independent variable for which the solution is equal to the initial values. One then proceeds in a step by step manner to change the independent variable and move across the required range.								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Discussion, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	30
Final Examination	1	60
Assignment	1	10

Recommended or Required Reading	
1	E Hairer, S P Norsett and G Wanner, Solving Ordinary Differential Equations I: Nonstiff Problems, (2nd edition), 1993, Springer-Verlag.
2	E Hairer and G Wanner, Solving Ordinary Differential Equations II: Stiff and Differential Algebraic Problems, (2nd edition), 1996, Springer-Verlag.
3	K W Morton and D F Mayers, Numerical Solution of Partial Differential Equations, 1994, Cambridge University Press.
4	A Iserles, Numerical Analysis of Differential Equations, 1996, Cambridge University Press.

Week	Weekly Detailed Course Contents	
1	Theoretical	Discrete methods for solving ODEs: Review of Runge-Kutta methods, linear multistep methods (Adams) convergence and order
2	Theoretical	Review of Runge-Kutta methods, linear multistep methods (Adams) convergence and order.
3	Theoretical	A number of practical ODE/PDE problems from different areas of applications will be introduced. They will be used and solved to illustrate ideas throughout the course. Implicit Runge-Kutta methods.
4	Theoretical	Stability regions, A-stability and other stability concepts. The BDF methods. Finite difference methods for linear equations and for more general problems.
5	Theoretical	The BDF methods. Finite difference methods for linear equations and for more general problems.
6	Theoretical	Implicit Runge-Kutta methods, deferred correction. Numerical solution of integral equations using different numerical methods.
7	Theoretical	Numerical solution of integral equations using different numerical methods.
8	Intermediate Exam	Midterm
9	Theoretical	Finite difference methods for heat equation, wave equation and Poisson's equation: The 5-point Formula
10	Theoretical	Numerical solution of parabolic Volterra-integro differential equations using Backward-Euler methods
11	Theoretical	Second order Numerical solution of parabolic Volterra-integro differential equations using CN methods
12	Theoretical	Numerical solution of hyperbolic Volterra-integro differential equations
13	Theoretical	Numerical solution of hyperbolic Volterra integral equations using Finite difference methods
14	Theoretical	Numerical error analysis
15	Final Exam	Final exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	3	3	84
Assignment	1	0	10	10
Project	1	0	20	20
Midterm Examination	1	30	2	32
Final Examination	1	45	2	47
			Total Workload (Hours)	193
			[Total Workload (Hours) / 25*] = **ECTS**	7.5
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	To develops skills in mathematics and computing in demand by industry
2	To solve problems and analize data in industry and commerce, such as biology (genomic research, medical imaging), engineering (computational mechanics), and digital libraries (indexing and searching vast corpuses of data).
3	To be able to define some mathematical concepts which are essential in his/her field
4	To be able to gain the skill of interpreting some interrelations among these concepts
5	To be able to use mathematical concepts in solving certain types of problems

Programme Outcomes *(Mathematics Doctorate)*	
1	To be able to develop the current and advanced knowledge of mathematics domain to expertise level by an original idea or research, based on the level of its knowledge at the graduate level, and to be able to reach original definitions that will bring innovation to Mathematics.
2	To be able to comprehend the interdisciplinary interaction associated with Mathematics.
3	To be able to use and evaluate the new knowledge in the field of Mathematics with a systematic approach.
4	To be able to develop an idea, a method, a design or an application that will bring innovation to Mathematics, to use well known ideas, methods, designs or applications on a different research area, or to search, comprehend, design, adapt and apply an original subject matter.
5	To be able to criticize, analyze, synthesize and evaluate new and complex ideas.
6	To be able have high-level skills in research methods related to studies on Mathematics.
7	To be able to expand the frontiers knowledge in the field of Mathematics via generating or interpreting an original study, or publishing at least a scientific paper in national/international refereed journals.
8	To be capable of leadership in the positions that require the analyses of problems related to the field of Mathematics.
9	To be able to defend his/her original ideas among the experts in the discussion of math related issues, and to be able to communicate effectively to show his/her competence in the field of Mathematics.
10	To be able to contribute to the solution of the social, scientific, cultural and ethical problems related to the Mathematics, and to be able to support the development of social, scientific, cultural and ethical values.
11	To be able to have both oral and written communication using a foreign language.
12	To be able to use computer software and information and communication technologies at an advanced level as required by mathematics.
13	To be able to supervise and teach values ??by taking into account social, scientific, cultural and ethical values ??during the collection, interpretation, application and announcement of mathematics-related data.
14	To be able to develop strategies, policies, and implementation plans for mathematics-related issues and to evaluate the results within the framework of quality processes.
15	To be able to apply the knowledge, problem-solving, and application skills acquired in mathematics to interdisciplinary studies.

Contribution of Learning Outcomes to Programme Outcomes *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

	L1	L2	L3	L4	L5
P1	3	4	4	4	4
P2	3	4	4	4	4
P3	3	4	4	4	4
P4	3	4	4	4	4
P5		4	4	4	4
P7		4			
P8	3				
P11	4	4			