Course Description	
Course Code	YS 423
Course Name	SCIENTIFIC PROGRAMMING
Prerequisite Courses	
Language of the Course	The English
Course Coordinator	-
Instructor(s)	-
Course Assistants	none
The aim of the course	The aim of the course is to learn to use software that can do scientific calculations and to advance with them level software development.
Course Content	Introduction to scientific programming, basics of software such as Matlab, Mathematica, Maple properties, basic calculations, syntax, basic input-output functions, logic and flow control, vectors and matrices, matrix operations, embedded functions, user defined functions, custom functions, graphical User Interface, Graphics (2D/3D drawing, graphic object handles, broadcast quality graphics, animations), basic calculus operations, complex numbers, polynomials, interpolation, Fourier series and fast Fourier transform, Numerical Linear Algebra, file operations (data import/export), communication with tables, code optimization, symbolic computations non-linear systems of equations, numerical optimization, parallel computing, parallel data processing, ordinary and partial differential equations, object-oriented programming, debugging

Weekly Course Content	
Week 1	Introduction to scientific programmings, such as Matlab, Mathematica, Maple key features of the software
Week 2	Basic calculations, syntax, operators, vectors and matrices, matrix operations
Week 3	Multidimensional arrays, M-files, basic input-output functions, logic and flow control
Week 4	Embedded functions, Data types (numeric arrays, cells, structures etc), user-defined functions
Week 5	User-defined functions, Graphics (2D/3D drawing, graphic object handles, broadcast-quality graphics, animations)
Week 6	Symbolic calculations, Basic Calculus Operations (Limit, Derivative, Integral, Taylor Series, etc.)
Week 7	Symbolic calculations (continued), equation solving, Laplace Transformation of complex numbers
Week 8	Midterm exam.
Week 9	Polynomials, interpolation, Fourier series and fast Fourier transform
Week 10	Numerical Linear Algebra (dense and sparse matrices, direct solvers and matrix decompositions, overdetermined and incomplete defined (underdetermined) linear systems, iterative solvers)
Week 11	Numerical Linear Algebra (continued,) Least squares approximation
Week12	Code optimization (vectorization, memory management)
Week 13	Ordinary and partial differential equations
Week 14	Project presentations
Week 15	Final exam.

Course Learning Outcomes	
1	To learn the necessary infrastructure to be able to make scientific calculations.
2	To learn how to develop software in a practical way using mathematical methods.
3	To learn to have knowledge and experience about programs that can perform numerical and symbolic calculations.
4	To learn to write optimized codes for mathematical algorithms.

Contribution of the Course to Program Qualifications		Contribution Level
01	The student will have the ability to apply analytical approach, mathematics and science knowledge in software and engineering issues.	5
02	The student will have the ability to identify, define, formulate and solve a problem in software and computer systems.	5
03	The student will have gains scientific research skills in software and engineering problems, has the ability to design a system, part or process.	5
04	The student will have the ability to use the design capability, techniques and tools required for engineering applications.	5
05	The student will have the ability to design, implement and interpret experimental work and software projects by analyzing the results.	5
06	The student will have the ability to work between disciplines and teamwork.	5
07	The student will have the ability to work in international environments and adapt to different cultures.	1
08	The student will have verbal and written communication skills in Turkish and English.	1
09	The student will have the awareness of the necessity of lifelong learning and the ability to realize it.	1
10	The student will gain knowledge of legal issues with the awareness of professional and ethical responsibility.	5
11	The student will have managerial skills (leadership, organization, time and risk management, quality awareness, efficiency, etc.).	1
12	The student will have the ability to participate in social activities, to acquire regular sports habits and to use time in the best way.	1
13	The student will have the ability to find unusual ways and produce projects.	5
14	The student will have professional self-confidence, being an entrepreneur and taking initiative.	3
15	It is sensitive about the problems of the age and looks after the national interests.	2

ECTS WORKLOAD			
	Number	**Duration (hours)**	**Number*Duration**
Face to face education	14	2	28
Out-of-class study time (pre-study, reinforcement)	0	0	0
Homeworks	2	7	14
Presentation / Seminar preparation	4	1	4
Quizzes	0	0	0
Preparation for midterm exams	1	7	7
midterm exams	1	2	2
Project (Semester assignment)	1	8	8
Lab	0	0	0
field work	0	0	0
Preparation for the final exam	1	15	15
Semester final exam	1	2	2
Research	0	0	0
TOTAL WORKLOAD			80
ECTS			**3**

Evaluation		
SEMESTER EVALUATION	**Number**	**Contribution Percentage**
Midterm	1	20
Quiz	0	0
Homework	2	20

SEMESTER TOTAL		**40**
Contribution rate of mid-term evaluations to success		40
Contribution rate of the final exam to success		60
GRAND TOTAL		**100**

RESOURCES	
Textbook	
Helpful Resources	• A Guide to MATLAB for Beginners and Experienced Users, B.R.Hunt, R.L.Lipsman, J.M. Rosenberg, Cambridge University Press, New York, 2001. • Scientific Computing with MATLAB and Octave, A. Quarteroni, F. Saleri, P. Gervasio, Springer, 4th ed, London, 2014. • Matrix Algorithms in MATLAB, O.U.Routh, Academic Press, 2016. • Accelerating MATLAB with GPU Computing A Primer with Examples, J.W.Suh, Y. Kim, Morgan Kaufmann, 2013. • Solving Optimization Problems using the Matlab Optimization Toolbox - a Tutorial, A. Geletu, 2007.