COURSE DESCRIPTION FORM	
Course Code and Name	CENG469 GENETIC ALGORITHMS AND PROGRAMMING (TECH. ELECT.)
Course Semester	7
Catalogue Data of the Course (*Course Content*)	Fundamentals of optimization, optimization in continuous and discrete space, single-state optimization algorithms, genetic algorithm fundamentals, schemata theorem, selection methods and population management models in genetic algorithms, binary coded genetic algorithm, continuous coded genetic algorithm, permutation coded genetic algorithm, NP-hard problems and its solution with genetic algorithm (traveling salesman problem solution), solution of binary problems with genetic algorithm (knapsack problem solution), preserving population diversity in genetic algorithm, solution of constrained optimization problems
Course Textbooks	Genetic Algorithms, Goldberg, Dorling Kindersley Pvt Ltd., 2008
Supplementary Textbooks	Evolutionary Optimization Algorithms, Dan Simon, Wiley, 2013. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 1996. Essentials of Metaheuristics, Sean Luke, 2015
Credit (*ECTS*)	6
Prerequisites for the Course (*Attendance Requirements*)	Obligatory course attendance
Course Type	Selective
Language of Instruction	English
Course Objectives	To introduce genetic algorithms that use evolutionary computing techniques to solve optimization problems. To explain the mathematical basis of genetic algorithms and to introduce the schemata theorem. To explain the methodology of genetic algorithms and to introduce various applications of these algorithms. To introduce genetic algorithms using different coding techniques. To explain how to use genetic algorithms in solving Np-hard problems.
Course Learning Outcomes	1. Knows the fundamentals of optimization 2. Knows traditional optimization methods 3. Knows single-state optimization algorithms 4. Knows the mathematical foundations of the genetic algorithm 5. Explains selection methods and population management models 6. Can solve binary encoded optimization problems with genetic algorithm 7. Can solve integer encoded optimization problems with genetic algorithm 8. Can solve continuous encoded optimization problems with genetic algorithm 9. Can solve permutation encoded optimization problems with genetic algorithm 10. Can solve NP-Hard problems with genetic algorithm 11. Knows the methods of preserving population diversity 12. Explains constrained optimization
Instruction Method *(Face-to-face, Distance education etc.)*	The mode of delivery of this course is face-to-face.
Weekly Schedule of the Course	1. Introduction to optimization 2. Traditional optimization methods 3. Single-state optimization algorithms 4. Introduction to genetic algorithms 5. Mathematical foundations of genetic algorithm: Schemata theorem 6. Selection methods and population management models 7. Binary encoded genetic algorithm 8. Solving the KnapSack problem with genetic algorithm 9. Integer encoded genetic algorithm 10. Continuous encoded genetic algorithm 11. Permutation encoded genetic algorithm 12. NP-Hard problem solving with genetic algorithm-TSP example 13. Preserving population diversity 14. Constrained optimization

Teaching Activities
(The time spent for the activities listed here will determine the amount of credit required)

Weekly theoretical course hours
Reading activities
Internet search and library work
Designing and implementing materials
Making a report
Midterm and revision for midterm
Final exam and revision for final exam

Assessment Criteria

	Number(s)	Weight (%)
Midterm exam	1	30
Assignment	0	
Application	0	
Project	1	30
Practice	0	
Quiz	0	
Final exam	1	40
Total	3	100

Workload of the Course

Activity	Number of Weeks	Duration (Weekly Hour)	End of Semester Total Workload
Weekly theoretical course hours	14	3	42
Weekly practical course hours			
Reading activities	14	1	14
Internet search and library work	14	2	28
Designing and implementing materials	3	10	30
Making a report	1	8	8
Preparing and making presentations			
Midterm and revision for midterm	1	15	15
Final exam and revision for final exam	1	15	15
Total workload			152
Total workload/ 25			6,08
Course Credit (ECTS)			6

Contribution Level between Course Outcomes and Program Outcomes

No	Program Outcomes	1	2	3	4	5
1	Knowledge of mathematics, science, basic engineering, computing, and computer engineering; ability to use this knowledge in solving complex engineering problems.					X
2	Ability to define, formulate and analyze complex engineering problems using basic science, mathematics and engineering knowledge and considering the UN Sustainable Development Goals relevant to the problems addressed.					X
3	Ability to design creative solutions to complex engineering problems; ability to design complex systems, processes, devices, software, algorithms or products to meet current and future requirements, considering realistic constraints and conditions.					X
4	Ability to select, use and develop appropriate techniques, resources and modern engineering and informatics tools, including estimation and modeling, for the analysis and solution of complex engineering problems while being aware of their limitations.				X	
5	Ability to use research methods to examine complex engineering problems or research				X	

		topics in computer engineering, including reviewing the literature, designing experiments, conducting experiments, collecting data, analyzing and interpreting results.					
	6	Knowledge of the effects of engineering practices and the standards used in these practices on society, health and safety, economy, sustainability and environment within the scope of the UN Sustainable Development Goals; awareness of the consequences of engineering solutions in the fields of information security and law.					
	7	Acting in accordance with engineering professional principles and knowledge on ethical responsibility; awareness of acting impartially, without discrimination on any issue, and being inclusive of diversity.					
	8	Ability to work effectively individually and as a team member or leader in intradisciplinary and multidisciplinary teams (face-to-face, remote, or hybrid).		X			
	9	Ability to conduct effective verbal and written communication on technical issues in Turkish or English, prepare reports, make effective presentations and prepare software documentation, considering the various differences of the target audience (such as education, language, profession).				X	
	10	Knowledge of business practices such as project, risk and change management and economic feasibility analysis; awareness of entrepreneurship and innovation.		X			
	11	Lifelong learning skill that includes the ability to learn independently and continuously, to adapt to new and developing scientific practices and technologies, and to think inquisitively about technological changes.				X	
Lecturer(s) and Contact Information	Assoc. Prof. Dr. Ümit ATİLA umitatila@gazi.edu.tr						