NUMERICAL ANALYSIS AND OPTIMIZATION METHODS IN AUTOMOTIVE ENGINEERING

1	Course Title:	NUMERICAL ANALYSIS AND OPTIMIZATION METHODS IN AUTOMOTIVE ENGINEERING	
2	Course Code:	OTO5102	
3	Type of Course:	Optional	
4	Level of Course:	Second Cycle	
5	Year of Study:	1	
6	Semester:	2	
7	ECTS Credits Allocated:	6.00	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:		
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Doç. Dr. EMRE İSA ALBAK	
15	Course Lecturers:	Prof.Dr. Necmettin Kaya	
16	Contact information of the Course Coordinator:	Doç.Dr. Emre İsa ALBAK Bursa Uludağ Üniversitesi Mühendislik Fakültesi Otomotiv Mühendisliği Bölümü	
17	Website:		
18	Objective of the Course:	The objective of this course is to present classical optimization techniques and stochastic (heuristic) methods of solving optimization problems in the automotive engineering, in additionally, there will be some introduction to numerical methods for optimization problems.	
19	Contribution of the Course to Professional Development:	Contribution of the course to professional development is about to have the knowledge and understanding of how to apply optimization techniques, heuristic techniques, optimumtopology design and numeric analysis in automotive industry	
20	Learning Outcomes:		
		1	Demonstrate knowledge and understanding of advances in numerical analysis and optimization techniques and ability to apply these technics to automotive engineering
		2	Explain the basic concepts and methods for optimization and numerical analysis techniques
		3	Demonstrate knowledge to model optimization and numerical analysis problems in mathematical form
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21	Course Content:		
	Course Content:		

Week	Theoretical	Practice
1	Basic principles in optimization techniques and numerical analysis	
2	Numerical methods for unconstrained optimization, Search methods, Lagrangian Multipliers, Kuhn-Tucker conditions	
3	Numerical methods for unconstrained optimization, Quasi-Newton Methods	
4	Numerical methods for constrained optimization, SUMT techniques for optimization, Penalty function method, Geometric programming method	
5	Traditional optimization techniques applications in automotive engineering	
6	Basic concepts of heuristic methods, applications of heuristic methods to automotive engineering problems	
7	Basic concepts of heuristic methods, applications of heuristic methods to automotive engineering problems	
8	Topology and shape optimization techniques for optimization engineering problems,	
9	Non-traditional optimization techniques applications in automotive engineering	
10	Numerical analysis techniques	
11	Numerical analysis techniques	
14	Project presentation	

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	3.00	42.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	14	2.00	28.00
Homeworks	0	0.00	0.00
Projects	1	100.00	100.00
Field Studies	0	0.00	0.00
Midterm exams	1	5.00	5.00
Others	0	0.00	0.00
Final Exams	1	5.00	5.00
Total Work Load			185.00
Total work load/ 30 hr			6.00
ECTS Credit of the Course			6.00

Materials:

J. S. Arora, Introduction to Optimum Design, Elsevier Academic Pres, New York, 1984.

G. N. Vanderplaats, Numerical Optimization Techniques

D. E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison Wesley

TERM LEARNING ACTIVITIES	NUMBE	WEIGHT
Midterm Exam	1	20.00
Home work-project	1	20.00
Final Exam	1	60.00
Total	3	100.00
Contribution of Term (Year) Learning Activities to Success Grade		40.00
Contribution of Final Exam to Success Grade		60.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		Midterm exam, Final exam, Homework

24 ECTS / WORK LOAD TABLE

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	0	0	4	5	0	4	0	0	0	0	0	0	0	0	0	0
ÖK2	0	0	4	5	0	4	0	0	0	0	0	0	0	0	0	0
ÖK3	0	0	5	5	0	4	0	0	0	0	5	0	0	0	0	0
LO: Learning Objectives PQ: Program Qualifications																
Contribution Level:	**1 very low**		**2 low**			**3 Medium**				**4 High**			**5 Very High**			