NUMERICAL ELECTROMAGNETICS

1	Course Title:	NUMERICAL ELECTROMAGNETICS	
2	Course Code:	EEM4224	
3	Type of Course:	Optional	
4	Level of Course:	First Cycle	
5	Year of Study:	4	
6	Semester:	8	
7	ECTS Credits Allocated:	4.00	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:	None	
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Doç. Dr. ESİN KARPAT	
15	Course Lecturers:		
16	Contact information of the Course Coordinator:	Dr. Öğr. Üye. Esin KARPAT Mühendislik Fakültesi Elektrik-Elektronik Mühendisliği Bölümü Ofis:320 0.224.294 20 20	
17	Website:		
18	Objective of the Course:	The students will learn to solve Electromagnetic Field problems with essential numerical techniques like FD,FDTD and etc..	
19	Contribution of the Course to Professional Development:	Students gain the ability to solve complex electromagnetic problems that cannot be solved analytically, via numerical methods.	
20	Learning Outcomes:		
		1	The students will learn the key tools, techniques and principles of computational approaches at electromagnetic theory
		2	The students will gain the ability to analyze and solve electromagnetic problems by homeworks and attendance to the lectures.
		3	The students will learn the processes to construct original methods, to develop analytical cogitation and problem solving approximations and techniques. will understand the basis developing original and independent software processes related to computational electromagnetics.
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21	Course Content:		
	Course Content:		

Week	Theoretical	Practice
1	Introduction to contemporary problems in electromagnetic wave engineering and techniques in computational electromagnetics	
2	Review of the Fundamentals of Electromagnetic Theory	
3	Finite Difference Methods. Derivation of finite difference from Taylor series and cutting error.	
4	Forward, Backward and Center difference formulas for first and second order derivatives	
5	Solution of parabolic, hyperbolic and elliptic partial differential equations with finite difference	
6	Application of finite differences to 1-D wave equations.	
7	Numerical dispersion of 1-D scalar wave equation, numerical stability of 1-D scalar wave equation, simple 1-D scalar wave source and absorber boundary conditions	
8	Maxwell equations, wave equations, Transverse Electric (TE) and Transverse magnetic (TM) polarization	
9	Introduction to Yee's definitions of central difference in space and time in 1-D. Numerical dispersion of 1-D Yee algorithm, numerical stability of 1-D Yee algorithm	
10	Introduction to Yee's definitions of central difference in space and time in 2-D. Numerical dispersion of 2-D Yee algorithm, numerical stability of 2-D Yee algorithm	
11	Analytical theory of absorber boundary applications of Liao absorber boundary conditions (ABC), introduction to Berenger	
12	Finite difference application examples	
13	Finite difference application examples	
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22	Textbooks, References and/or Other Materials:	Sevgi, L. Elektromanyetik Problemler ve Sayısal Yöntemler, Birsen Yayınevi, 1999. Electromagnetics ,CRC Press,2001. - F. B. Hildebrand, "Finite-Difference Equations and Equations", Wiley-Eastern Limited, 1984. - Richard.C.BOOTON,"Computational Methodes for Electromagnetics and Microwaves",John Wıley and Sons,1992. - Dennis M.SULLİVAN,"Electromagnetic Simulation Using the FDTD Method", 2nd Edition,Wiley-IEEE Press,2013
23	Assesment	

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	3	6.00	18.00
Homeworks	2	12.00	24.00
Projects	0	0.00	0.00
Field Studies	0	0.00	0.00
Midterm Exams	1	16.00	16.00
Others	0	0.00	0.00
Final Exams	1	16.00	16.00
Total Work Load			116.00
Total work load/ 30 hr			3.87
ECTS Credit of the Course			4.00

TERM LEARNING ACTIVITIES	NUMBER	WEIGHT
Midterm Exam	1	20.00
Quiz	0	0.00
Home work-project	2	20.00
Final Exam	1	60.00

Total	4	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, Homewark and Final Exam

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	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK2	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK3	0	0	0	5	0	0	0	0	0	0	0	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**