

ADVANCED MATRIX METHODS IN EARTHQUAKE ENGINEERING

1	Course Title:	ADVANCED MATRIX METHODS IN EARTHQUAKE ENGINEERING
2	Course Code:	INS5018
3	Type of Course:	Optional
4	Level of Course:	Third 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:	Prof. Dr. M.ÖZGÜR YAYLI
15	Course Lecturers:	Doç. Dr. M. Özgür YAYLI
16	Contact information of the Course Coordinator:	bdeliktas@uludag.edu.tr 224 2900744 Uludağ Univ. Müh.Mim Fak. İnşaat Müh. Böl. Görükle, Bursa
17	Website:	http://insaat.uludag.edu.tr
18	Objective of the Course:	<p>-Representation of equilibrium equations in matrix form in bearing elements and systems under various loads (static and dynamic loads)</p> <p>-Performing internal force, strain and displacement calculations of bearing elements and systems with matrix methods</p> <ul style="list-style-type: none"> • To gain the ability to set up an algorithm to apply the matrix-displacement method for practical solution of bearing elements and systems under the effects of different forces and under different behavior patterns.
19	Contribution of the Course to Professional Development:	<ul style="list-style-type: none"> • Ability to solve frame type building systems under static loads by matrix displacement method • Ability to perform free vibration analysis of load-bearing systems and establish an algorithm • Ability to apply the mode superposition method and set up an algorithm for automatic calculation
20	Learning Outcomes:	
	1	• Ability to solve frame type building systems under static loads by matrix displacement method
	2	• Ability to perform free vibration analysis of load-bearing systems and establish an algorithm
	3	• Ability to apply the mode superposition method and set up an algorithm for automatic calculation
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21	Course Content:	
	Course Content:	
Week	Theoretical	Practice
1	Introduction to matrix methods, purpose, definitions, basic matrix operations	
2	Relations between edge forces and edge displacements in finite elements, changing axes	
3	Direct matrix replacement method	
4	Special supports, symmetrical systems, support transverse displacements, rods resting on elastic foundation, rods where second-order effects are taken into account, etc.	
5	Two and three dimensional elements	
6	Two and three dimensional elements (continued)	
7	Calculation of nonlinear systems, Nonlinear systems in terms of material, nonlinear systems in terms of geometry change, Nonlinear systems in terms of material and geometry change	
8	Calculation of structural systems according to dynamic external effects, equation of motion, free vibrations, harmonic forces, earthquake effects	
9	Forced vibrations, numerical integration techniques	
10	Free vibration analysis, calculation methods, properties of vibration modes	
11	Superposition method of modes	
12	Detailed examples of the application of the superposition method of modes	
13	Unit force matrix, loading terms	
14	Writing continuity equations in matrix power method and solution	
22	Textbooks, References and/or Other Materials:	<ul style="list-style-type: none"> • Prof. Dr. Erkan Özer ve Prof.Dr. Faruk Karadoğan tarafından hazırlanan ders notları (Course notes prepared by Prof. Dr. Erkan Özer and Prof.Dr. Faruk Karadoğan) • Çakıroğlu, A., Özden, E., Özmen, G. Yapı Sistemlerinin Hesabı İçin Matris Metotları ve Elektronik Hesap Makinesi Programları, Cilt I ve Cilt II, İTÜ Kütüphanesi, Sayı 1005, 1992. • Prezemieniecki, J.S. Theory of Matrix Structural Analysis, Dover Pub. ISBN 04866-49482,1985. • Bathe, K.J. Finite Element Procedures, Prentice-Hall, 1996. • Hart, G.C., Wong, K. Structural Dynamics for Structural Engineers, J.Wiley, 2000. • Meek, J.L. Matrix Structural Analysis, McGraw-Hill, ISBN 0070413169, 1971. • Clough, R.W., Penzien, J. Dynamics of Structures, McGraw-Hill, 1996.
23	Assesment	
TERM LEARNING ACTIVITIES		NUMBE R
Midterm Exam		1
		WEIGHT
		40.00

Quiz	0	0.00
Home work-project	0	0.00
Final Exam	1	60.00
Total	2	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	Understanding the principles of applied mathematics used in the course	

24	ECTS / WORK LOAD TABLE
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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	4.00	56.00
Homeworks	14	3.00	42.00
Projects	14	1.00	14.00
Field Studies	0	0.00	0.00
Midterm exams	1	3.00	3.00
Others	14	1.00	14.00
Final Exams	1	3.00	3.00
Total Work Load			177.00
Total work load/ 30 hr			5.80
ECTS Credit of the Course			6.00

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
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	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16
ÖK1	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK2	5	5	3	0	5	5	0	0	0	0	0	0	0	0	0	0
ÖK3	5	3	0	0	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
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