COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P+L Hour*	*Credits*	*ECTS*
Matrix Methods in Structural Analysis	CE 531	-	3+0+0	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Master's Degree (Second Cycle Programmes)
Course Type	Departmental Elective
Course Coordinator	Asst. Prof. Dr. Özden Saygılı
Instructors	Asst. Prof. Dr. Özden Saygılı
Assistants	-
Goals	This course is designed for students to advance in analysis of statically indeterminate structures using matrix formulation.
Content	Review of analysis of statically indeterminate structures Slope deflection equations: basis for matrix formulation Analysis of beams, trusses and frames using matrix displacement method Introduction to nonlinear analysis of structures Geometric nonlinearity – P delta effect

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
Ability to analyze planar beams using matrix formulation.	1, 3, 9	1, 2, 3	A, B
Ability to analyze trusses using matrix formulation.	1, 3, 7, 9	1, 2, 3	B
Ability to analyze planar frames using matrix formulation.	1, 3, 9	1, 2, 3	A, B

Teaching Methods:	1: Lecture, 2: Problem solving by instructor, 3: Problem solving assignment
Assessment Methods:	A: Written exam, B: Homework

COURSE CONTENT

Week	Topics	Study Materials
1	Review of analysis of statically indeterminate structures: Displacement methods	Lecture Notes
2	Review of analysis of statically indeterminate structures Slope deflection equations: basis for matrix formulation	Lecture Notes
3	Stiffness and flexibility matrix of a beam element (Coordinate transformations, global analysis theory)	Lecture Notes
4	Analysis of statically indeterminate beams using matrix displacement method (Shear deformation effects in beam elements) (Nodal deflections, reactions, and internal forces)	Lecture Notes
5	Analysis of statically indeterminate beams using matrix displacement method (Beam element end forces, shear and moment diagrams) Assignment I	Lecture Notes
6	Analysis of statically indeterminate trusses using matrix displacement method (Truss bar element stiffness matrix in local and global coordinates)	Lecture Notes
7	Analysis of statically indeterminate trusses using matrix displacement method (Symmetrical and antimetrical loading) Assignment II	Lecture Notes
8	MIDTERM	Lecture Notes
9	Analysis of statically indeterminate frames using matrix displacement method (Frame element stiffness matrix in local and global coordinates) (non-prismatic members)	Lecture Notes
10	Analysis of statically indeterminate frames using matrix displacement method (Examples of frames with inclined beams) Assignment III	Lecture Notes
11	Analysis of statically indeterminate frames using matrix displacement method – Hinge example Assignment IV	Lecture Notes
12	Introduction to nonlinear analysis of structures Geometric nonlinearity (Geometric stiffness matrices for planar elements)	Lecture Notes
13	Introduction to nonlinear analysis of structures (Geometric nonlinearity – P delta effect) Assignment V	Lecture Notes
14	Introduction to nonlinear analysis of structures (Geometric nonlinearity – P delta effect) Assignment VI	Lecture Notes
15	Beyond matrix method: introduction to finite element method	Lecture Notes

RECOMMENDED SOURCES	
Lecture Notes	These are the notes that the students wrote during the lectures.
Textbook	-
Additional Resources	McGuire, W., Gallagher R.H., and Ziemian, R.D., “Matrix Structural Analysis,” Second Edition, John Wiley and Sons, Inc., 2000. Tartaglione, L.C., “Structural Analysis,” International Edition, McGraw-Hill, Singapore, 1991

MATERIAL SHARING	
Documents	-
Assignments	Assignments are returned to students after they are graded.
Exams	Exams questions are solved if demanded.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterm (30%)	1	50
Assignments (30%)	6	50
	-	-
	-	-
	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Attains knowledge through wide and in-depth investigations his/her field and surveys, evaluates, interprets, and applies the knowledge thus acquired.			√			
2	Has a critical and comprehensive knowledge of contemporary engineering techniques and methods of application.						
3	By using unfamiliar, ambiguous, or incompletely defined data, completes and utilizes the required knowledge by scientific methods; is able to fuse and make use of knowledge from different disciplines.			√			
4	Has the awareness of new and emerging technologies in his/her branch of engineering profession, studies and learns these when needed.						
5	Defines and formulates problems in his/her branch of engineering, develops methods of solution, and applies innovative methods of solution.						
6	Devises new and/or original ideas and methods; designs complex systems and processes and proposes innovative/alternative solutions for their design.						
7	Has the ability to design and conduct theoretical, experimental, and model-based investigations; is able to use judgment to solve complex problems that may be faced in this process.			√			
8	Functions effectively as a member or as a leader in teams that may be interdisciplinary, devises approaches of solving complex situations, can work independently and can assume responsibility.						
9	Has the oral and written communication skills in one foreign language at the B2 general level of European Language Portfolio.			√			
10	Can present the progress and the results of his investigations clearly and systematically in national or international contexts both orally and in writing.						
11	Knows social, environmental, health, safety, and legal dimensions of engineering applications as well as project management and business practices; and is aware of the limitations and the responsibilities these impose on engineering practices.						
12	Commits to social, scientific, and professional ethics during data acquisition, interpretation, and publication as well as in all professional activities						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Midterm	1	2	2
Assignment	6	9	54
Final	1	2	2
Total Work Load			240
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10