AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Variational Methods in Engineering								
Course Code	MCE521		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	8	Workload	200 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	Teaching Variational Methods in Engineering in graduate level and giving the ability of using them in engineering and mathematical physic problems								
Course Content	Problems of minimization and maximization. Functionals. Classical problems in calculus of variations, Euler equations, Variational notation, Natural boundary conditions, Hamilton's principle, Lagrange equations. Transformation of boundary value problems into the problem of calculus of variation. Direct methods; Ritz method, Galerkin method, Kantorovich method, Weighted residual method. (Applications on Fluids, Solids and Structural Engineering problems.)								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Case Study, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	2	40
Final Examination	1	40
Assignment	4	20

Recommended or Required Reading	
1	Methods of Applied Mathematics, F. B. Hildebrand, 2nd edition, 1965 Prentice-Hall, Inc.
2	Energy and Variational Methods in Applied Mechanics, J. N. Reddy, 1984
3	Energy Methods in Applied Mechanics, H. L. Langhaar, 1962
4	Solid Mechanics: A Variational Approach, Clive L. Dym, Irving H. Shames, 1973 McGraw-Hill
5	Foundations of Solid Mechanics, Y. C. Fung, 1965 Prentice-Hall, Inc.
6	Mathematics of Physics and Modern Engineering, Sokolnikoff and Redheffer, 1958 McGraw-Hill.

Week	Weekly Detailed Course Contents	
1	Theoretical	Problems of minimization and maximization.
2	Theoretical	Functionals.Classical problems in calculus of variations,
3	Theoretical	Euler equations,
4	Theoretical	Variational notation
5	Theoretical	Natural boundary conditions
6	Theoretical	Hamilton's principle,
7	Theoretical	Lagrange equations.
8	Theoretical	Transformation of boundary value problems into the problem of calculus of variation
9	Intermediate Exam	Midterm Exam
10	Theoretical	Direct methods; Ritz method,
11	Theoretical	Galerkin method
12	Theoretical	Kantorovich method,
13	Theoretical	Weighted residual method. (Applications on Fluids, Solids and Structural Engineering problems.)

14	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	3	3	84
Assignment	4	0	6	24
Midterm Examination	2	26	3	58
Final Examination	1	31	3	34
			Total Workload (Hours)	200
			[Total Workload (Hours) / 25*] = **ECTS**	8
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	formulate variational problems
2	analyse problems to deduce key properties of system behaviour
3	Having the knowledge about Variational Methods İn Engineering in graduate level
4	Having the ability of using Variational Methods in calculation of eigenvalues and eigenfunctions of mathematical problems in engineering
5	Solving simple initial boundary value problems by using several variable calculus.

Programme Outcomes *(Civil Engineering Master)*	
1	To be able to develop expertise knowledge in a Civil engineering area founded on their graduate competence.
2	To be able to use the theoretical and practical expertise knowledge gained in their specialty area.
3	To be able to use the information, problem solving and / or practical skills from the field, in interdisciplinary studies.
4	To be able to create new knowledge by integrating their knowledge area with the knowledge coming from different disciplines; and solve problems that need expertise by using scientific research methods
5	To be able to solve the problems related to his/her area by using appropriate research methods
6	To be able to devise a problem in their specialty area, develop a solution methodology, solve the problem, and interpret the results and take action if necessary
7	To be able to criticize the knowledge in their specialty area, guide the learning process, and independently direct high level studies
8	To be able to systematically communicate the recent developments in their specialty area and their own studies to groups both inside and outside their specialty area, orally, in writing and visually
9	To be able to use computer software at a level required by their specialty area with drawing upon information and communication technology at a high level
10	To be able to introduce scientific, technological, social and cultural advancements in the field of civil engineering and to contribute to the process of being an information of the society and to sustain it.
11	To be conscious of professional and ethical responsibility and contribute to the establishment of this consciousness.
12	To be able to protect social, scientific, and ethical values during collection, interpretation, and dissemination stages of the data associated with their specialty area; instruct and supervise these values
13	To be able to use at least one foreign language in a level to follow current developments related to the field.

Contribution of Learning Outcomes to Programme Outcomes *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

	L1	L2	L3	L4	L5
P1	5	5	5	4	5
P2	4	4	4	5	4
P3	5	5	5	4	5
P4	4	4	4	4	4
P5	5	5	5	5	5
P6	4	4	4	4	4
P7	5	5	5	5	5
P8	4	4	5	4	4
P9	5	5	5	5	5
P10	4	5	4	4	5
P11	5	4	4	5	4
P12	4	5	4	4	5
P13	5	4	5	5	4