GAZI UNIVERSITY

FACULTY OF ENGINEERING AND ARCHITECTURE

MECHANICAL ENGINEERING DEPARTMENT

EUROPEAN CREDIT TRANSFER SYSTEM INFORMATION PACKAGE

FOR GRADUATE PROGRAM

CONTENTS

DEPARTMENT OF MECHANICAL ENGINEERING

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DEPARTMENT

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GENERAL INFORMATION

“Zafer Engineering and Architecture Academy” which had begun education in 1966; “Yükseliş Engineering and Architecture Academy” which had begun education in 1967 and “Anadolu Chemical Engineering Academy” which had begun education in 1968 were officialised with the effectuated 1472 numbered Law and joined the structure of Economical and Political Sciences Academy. Two years later these Academies were joined under the name “Ankara Engineering and Architecture Academy” and were converted into the Ankara Engineering and Architecture State Academy which was found the same year.

The Academy was integrated to the “Gazi University” constitution which was found by the 2809 numbered Law, regulating the acknowledgement of the change of delegated legislation about “Higher Education Councils Association” in 1982; and so formed the current “Gazi University Engineering-Architecture Faculty”.

Mechanical Engineering Department maintains its undergraduate education since 1966 in commitment with a number of associations and institutes. Following the closure of 1992/93 academic year, the secondary education was included in the primary education and the student enrollment was begun. Beginning from the 1993/94 academic year, partial education in foreign language came into being. Currently more than %60 of the courses is instructed in English.

As from the activation of Institute of Science and Technology in Gazi University in 1993, graduate education (Master of Sciences and PhD) in Mechanical Engineering Department has begun.

Mechanical Engineering Department was accredited by MÜDEK in 2004.

Currently the department has 16 professors, 4 associate professors, 11 assistant professors, 4 lecturers, 19 research assistants, 1 specialist and 2 technicians. The main study fields of the department are Construction and Production, Mechanics, Machine Theory and Dynamics, Heat Transfer, Energy and Thermodynamics.

The department possesses closed localities which are divided into three parts (administrative units, classrooms and laboratories). Two laboratories are found in classes building and the rest 13 are in the Laboratory building.

LABORATORIES

1. Aerodynamics Laboratory:

The Laboratory owns a test system to determine the pump performances, air-conditioning room test system which provides the specification of the convenience conditions according to the orifice and blow types; and a wind tunnel.

2. Fluid Mechanics Laboratory:

This laboratory is equipped with necessary experimental set-ups and rigs for the purpose of showing the student basic fluid mechanics laws and concepts experimentally. Some of these concepts are: fluid tracing system, forced vortex, thermal conduction device and thermocouple calibration device, frictional loss inside pipes, laminar flow table, centrifugal pumps and turbine test systems. In addition to these test systems, there are other experimental setups used for research projects in the Laboratory.

3. Computer Laboratory:

The laboratory is equipped with 30 Pentium-4 based computers for the purpose of supporting and enriching undergraduate and graduate course contents as well as conducting various research works. Computers in the laboratory are interconnected and also connected to all network systems via Internet.

This laboratory is used for a number of design and lecture application purposes. There are 30 computers, one TOSHIBA TLP S-10 projector and an HP LaserJet 1020 printer to be used by students.

4. Experimental and Numerical Heat Transfer Laboratory:

Experimental and numerical heat transfer laboratory is related to the convection event and has been developed to make researches and to improve teaching in this field. The study in this laboratory is directed to the areas which include the simulations of forced convection in ducts and natural convection on surfaces. The laboratory is equipped with computers which are: Sun Ultra 60, IBM M Pro IntelliStation, HP Vectra VL, and HP Vectra VE. The software in these computers is CFX Version 5.5.1, STORM/CFD 2000 Version 4.11, CFD-ACE+ Version 6.6. Experimental studies are carried out for forced convection in ducts and for natural convection on surfaces. Then the results are compared with the results of the theoretical results of the software.

5. Thermal Sciences Laboratory:

This laboratory is equipped with modern measuring instruments. Experimental setups which are suitable for students include heat exchangers, natural convection, condensation and boiling. Also experiments involving the measurement of the heat transfer coefficient at low temperatures and evaluation of the characteristics and dynamic responses of heat exchangers can be fulfilled. Test systems for the measurement of thermal efficiency of solar collectors are also present. Experiments related to refrigeration systems can be performed in the Laboratory too. The efficiencies of the steam-pressurized refrigeration systems can be determined at the experiment room.

6. Thermal Power Laboratory:

The thermal power laboratory contains experimental devices, equipment, instrumentation and various stationary and mobile measuring systems for conducting basic and applied research on combustion, emission control and industrial energy saving strategies. Some of the available test stands are; a boiler test centre for thermal performance and emission tests of boilers up to 600 000 kcal/h capacity, stove test system for the improvement of domestic stoves, research and development test rigs on cold and hot circulating fluidized bed combustion systems, cooling tower test systems. In addition, the laboratory contains a "Mobile Emission Test Laboratory" for conducting research, development and industrial application studies concerning energy-environment-industrial rehabilitation.

7. Internal Combustion Engines and Automotive Laboratory:

In this laboratory tests and performance analyses can be made on two and four stroke gasoline/diesel engines and Vankel engines by making use of electric and hydraulic dynamometers and Prony brakes. Performance analysis, tests with Ricardo engine, Investigation of combustion with indicators and other instruments, and emission measurements can also be conducted. Experimental rigs concerning automotive electric, gas and ignition systems are available. There are also jet turbines, one and two row star engines, various other engines, engine parts and gas sampling systems available for demonstration purposes.

8. Laser Doppler Laboratory:

In this laboratory, there is a 2-dimensional velocity gauge which enables the velocity and turbulence measurements without interrupting the flow, and testing equipment related to graduate studies.

9. Materials-Metallography Laboratory:

The laboratory is composed of 15 optical microscopes with x1500 magnification, specimen cutting, mounting, grinding and polishing equipment and ultrasonic cleaning machine. Various acids and chemical agents are available for etching purposes.

10. Strength of Materials Laboratory:

The laboratory owns a digitally-controlled servo hydraulic DARTEC tensile test machine with a 600 kN tensile and compressive force capacity; a manual-controlled Wolpert tensile machine with 400 kN capacity; a Techequipment branded Izod and Charpy Impact test machine, a Techequipment branded torsion test machine with 200 Nm torque capacity; a

Rockwell hardness test machine and 10-channel strain gauge. Mentioned machines are used for the educational and research applications, and also capable of meeting the experiment demands of the industry.

11. Mechanical Vibrations and Noise Control Laboratory:

The testing equipments related to vibrations, vibration measuring gauges and analyzers are presented to the students and researchers. There is a simulation system in capable of providing earthquake and wind simulations and a computerized sensor system in capable of making 3-dimensional analyses. Additionally, a experiment rig is set up for students to learn the pre-alerting dynamic maintenance. For the use of this, there are 2 mobile analyzers. One Type-1 and two Type-2 audio level gages for the use of acoustic measurements; an analyzer which can make 1/1, 1/3, 1/16 FFT analysis and determine the echo durations; a measurement-set which is composed of an audio level gage to be used at the environmental noise measurements, a data-collector card, and a computer. Finally, 3 licensed software for modelling highway; railway and airway communication exists in the Laboratory.

12. Mechanisms and Machine Dynamics Laboratory:

Various models of mechanisms about dynamics, machinery dynamics, and mechanisms are available for training purposes. Also, experimental setups for critical spindle speed and vibration are available as well as balance machines, vibration and balance analyser, gyroscopic systems and other training related.

13. Automatic Control Laboratory:

In the laboratory setups for training and research purposes in the automatic control field are present. Two robotic arms with 5-degree of freedom, one of which is made completely in our department, exists in this Laboratory. Studies are conducted in the field of hydraulic and pneumatic systems, computer aided machine and robot control, numerical hydraulic system control and industrial process control.

14. Machine Tools Laboratory:

Various type of milling machines, lathes, drilling machines, shapers, grinders, NC milling and CNC turning machines are available. The laboratory is serving as the production shop and the research laboratory for the chip removal processes in the department. All the machine tools are in good condition to achieve precision machining. All the setting equipment, cutting tools and measurement devices are available.

15. Powder Metallurgy Laboratory:

The laboratory which is the strongest in its subject in Turkey owns these equipments: a pilot-size gas atomization unit, experimental-size gas atomization unit, particle size at 0.1-1000 micrometer range with laser measurement device, industrial-size powder injection moulding frame, centrifuge and ultrasound baths, complete sieve set and shaker, vibrant grinder, thrust ball grinder, 3-dimensional mixer, temperature-controlled tube furnace, visible density and powder fluency measurement device, accurate balance, powder classification device, transverse fracture experiment set, capillary reometer, 30 Litre capacity liquid Nitrogen tank, 5 Litre liquid Nitrogen steel tank, various powder compaction dies, 20 kg capacity induction burner and 50 kg capacity melting burner.

GRADUATE PROGRAM

Graduate and Doctorate programs with theses are conducted at Mechanical Engineering Department.

Education Objects (Our Vision)

Gazi University maintains being a leading establishment through the establishments alike which give an education at international level, fulfill research and achieve information, with publishing these serving the society and mankind, emphasizing the technologic development in parallel with national demands.

Genuine Task (Our Mission)

By giving professional and graduate education, to train up and guide Mechanical engineers with Bachelor's and/or Doctorate Degree, who are creative enough to participate manufacturing, application and Research Development studies in industrial enterprises and research institutes successfully; have a systematic point of view at solving problems, are suitable for team works, environmentally-conscious, social, having economical and professional ethic consciousness and responsibility, owning leading characteristics; and making researches providing information and technology development at international level.

Objects of the Program

- Providing the student the ability to apply the mathematics, science and engineering acquirements to mechanical engineering problems.
- Procuring the student the necessary theoretical and practical information to design and produce a machine, or a machine element, its system or process by considering the relevant standards, limitations and economical, performance, environmental and social effects.
- Providing the student the capability of specifying the mechanical engineering problems, formulating, modeling, analyzing and solving ability, and if necessary building up an experiment, processing and analyzing its results and commenting on them and presenting it. With this purpose, providing the students to use the necessary modern engineering calculation and presentation equipments.
- Preparing students for undertaking tasks as a leader or a member of multidisciplinary team at organizations in which mechanical engineering is applied. For this purpose training them to have an efficient demonstrative and oral communication capability. Providing them to realize the global, social and cultural effects of this profession, professional and ethical responsibilities. Providing them the necessary facilities to own an up-to-date and modern intelligence.

Graduate Education and Grading System

For graduate students to achieve Master of Science (MSci) and Doctorate (PhD) degrees, they have to choose a Thesis subject which is approved by the Department and prepare it with passing the relevant graduate courses. Graduate education consists of 7 courses, 1 seminary and 1 thesis; while doctorate education consists of 7 courses, doctorate proficiency exam and 1 thesis. Further information is given about the courses, seminary and doctorate proficiency exam below.

Courses

- Other than the midterms and/or studies during semester, students are due to finals and/or projects evaluations. Final exam program which is specified by the relevant Department is approved by the Institute and is announced by the Department.
- For the graduate students' courses to be evaluated at the end of the semester, they have to satisfy the conditions specified and announced at the beginning of the semester by the course instructor. Criteria for the course achievement are announced to the students at the beginning of the semester and notified to the relevant Department. Evaluation at the end of the semester is done according to these criteria.
- There is no make-up examination for graduate courses.
- Students may take the courses which they could not achieve at the course enrolling period or another course at the equivalent credit value, with the approval of the Department.
- Students may be qualified for a make-up exam in case he/she could not attend any of the midterms for a reason which is approved by the instructor.
- Grade is specified as follows:
- At the end of the semester, the grade of a credit-course is determined by the instructor, by evaluating the midterms and/or studies during semester and/or project studies. One of the literal grades explained below is given to the student:

Catalog Value	Literal Grade	Coefficient
90-100	AA	4,00
85-90	BA	3,50
80-84	BB	3,00
75-79	CB	2,50
70-74	CC	2,00
65-69	DC	1,50
60-64	DD	1,00
50-59	FD	0,5
49 and below	FF	0,0

In addition to these, grades given below are used for the literal notes different from above:
B: Successful
K: Unsuccessful - fails
D: Incomplete / did not attend the classes
G: did not take the final exam.

During the specification of the ECTS grade, the suggested distributions of ECTS are also considered.

ECTS Grade	% of successful students normally achieving the grade	Definition
A	10	EXCELLENT - outstanding performance with minor errors
B	25	VERY GOOD - above the average standard but with some errors
C	30	GOOD - generally sound work with a number of notable errors
D	25	SATISFACTORY - fair but with significant shortcomings
E	10	SUFFICIENT - performance meets the minimum criteria
FX	-	FAIL - some more work required before the credit can be awarded
F	-	FAIL - considerable further work is required

- To be considered as successful for a course, students have to get minimum CC at graduate education, and minimum CB at Doctorate.
- The weighted grade of a student for a course is calculated by the multiplication of the credit value of that course and the coefficient of the literal grade. GPA is calculated by dividing the weighted semester grade with the total credit number of the enrolled courses.
- Cumulative GPA is calculated by considering all the courses which are enrolled by the student from the beginning of Master of Science education, in order to complete the minimum number of credits that are specified by the Department. Students may enroll the courses again to obtain a higher cumulative GPA. The last grade of the re-enrolled course is considered for the GPA calculations. All grades are stated at the student's Grade Table.
- For graduation, cumulative GPA should be minimum 3.0/4.0.
- Students who do not satisfy the course attendance conditions or the course laboratory conditions cannot obtain the right to take the final exam and are considered to be Incomplete (D) and get the literal grade FF. Courses like Thesis study, Seminary and Semester Project are evaluated as Successful (B) or Unsuccessful (K). Grades B and K are not considered at the GPA calculations. Student who does not attend the exams gets G and has the same process as FF.
- The exam results are not to be objected, except for the errors of fact which may lead to court decisions. Student may submit his written application to the Institute in 2 weeks starting from the exam results' announcement. Applications made later are not taken into consideration. The error of fact application is reviewed by a Commission which is formed by the relevant Department and informs the Institute in 10 days. If specified, the error of fact is edited by the Institute.

Seminary

These courses are presentations that are conducted according to the program which is designated by the Department. Programs are planned for the Seminary course and Semester Project that continues throughout the semester. Since these courses are demonstrative, attendance is controlled by the Department and the supervisors are informed.

Doctorate Proficiency Exam

The purpose of the Proficiency Exam is to determine the student whether he/she acquires the basic mechanical engineering knowledge and is ready for the doctorate studies or not. In accordance, the exam includes the undergraduate and graduate basic courses and specific subjects of the doctorate.

Proficiency exam consists of 3 stages:
1. Undergraduate level written exam
2. Graduate level written exam
3. Oral exam (consisting of undergraduate and graduate subjects).

To be successful, candidate has to achieve minimum average grade of 75 from each stage exam. To take the oral exam, candidate has to be successful at the previous 2 exams. The candidate is exempted from one of his successful exams when he/she is unsuccessful at another at his/her 1st trial.

The following principles are valid for the written exams:

- Undergraduate level written exam consists of the subjects below according to his/her topic of study:

Heat Group	**Mechanics Group**
Thermodynamics	Statics
Heat Transfer	Dynamics
Fluid Mechanics	Mechanics of Materials
Mathematics	Mathematics

- Graduate level written exam consists of 4 courses given below which are selected according to the candidate's topic of study (provided that one of the selected courses is mathematics). It is not obligatory for the candidate has enrolled the courses he/she selects.

Heat Group Graduate level Written Exam Courses

MM 591 Analytical Methods in Mechanical Engineering
MM 597 Advanced Numerical Methods in Engineering

MM 601 Advanced Fluid Mechanics
MM 546 Viscous Flow
MM 596 Conduction Heat Transfer
MM 564 Convection Heat Transfer
MM 538 Advanced Thermodynamics
+ A course suggested by the supervisor (can be selected from the list or a course of the department relevant with the student's research area.)

Heat Group Graduate level Written Exam Courses

MM 591 Analytical Methods in Mechanical Engineering
MM 597 Advanced Numerical Methods in Engineering

MM 503 Advanced Dynamics
MM 504 Advanced System Dynamics and Optimum Control
MM 507 Advanced Mechanics of Materials
MM 515 Mathematical Theory of Plasticity
MM 523 Continuum Mechanics
MM 531 Applied Elasticity
MM 560 Control System Design
MM 577 Advanced Machine Vibrations
+ A course suggested by the supervisor (can be selected from the list or a course of the department relevant with the student's research area.)

The student specifies with his/her supervisor the courses he/she will take the exams of and informs the department at the beginning of the semester.

3 questions are asked to the student from each course he/she takes the exam and the student selects and answers 2 of each.

Each written exam is made at 2 sessions, which is minimum 2 hours long.

Degrees Granted

Students achieve one of the degrees explained below when they graduate from the Gazi University Faculty of Engineering and Architecture Mechanical Engineering Graduate Program:

Master of Science (with Thesis) Degree	2 years** (4 semesters)
Master of Science (without Thesis) Degree	3 years*** (6 semesters)
Philosophy of Doctorate Degree	4 years** (8 semesters)

** Maximum 2 years can be given as additional time period to the students who satisfy the necessary conditions.
*** This program exists in the secondary education program. Expenses are met by the students at the secondary education program.

5001010 MS THESIS	MECHANICAL ENGINEERING DEPARTMENT

Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	14		200			36	250	0	10

Language	Turkish
Compulsory / Elective	Compulsory
Prerequisites	Assignment of the supervisor
Course Contents	MS thesis work
Course Objectives	To improve the ability of getting the scientific information, its evaluation and interpretation by conductive scientific research
Learning Outcomes and Competences	To have the ability of getting the scientific and technological information, and engaging in life-long learning To have the ability of evaluation and interpretation
Textbook and /or Reference	All the references related to the study.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		

Instructors	The supervisor

Week	**Subject**
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5980010 SEMINAR									**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	28	80	80				188	0	7.5

Language	Turkish
Compulsory / Elective	Compulsory
Prerequisites	Assignment of the supervisor
Course Contents	Presentation of the thesis work
Course Objectives	• To give the ability of the oral presentation and discussion • To decide on the objectives of the thesis work and the strategy
Learning Outcomes and Competences	• To have the ability of the oral presentation and discussion • To have an ability of determining the objectives and the strategy of a scientific work
Textbook and /or Reference	All the references related to the study.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		

Instructors	The supervisor

Week	**Subject**
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6001010 PhD THESIS							**MECHANICAL ENGINEERING DEPARTMENT**		
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	14		200			36	250	0	10

Language	Turkish
Compulsory / Elective	Compulsory
Prerequisites	Assignment of the supervisor
Course Contents	PhD thesis work
Course Objectives	• To give the ability of carrying out independent research, • To give the ability of deducing conclusions scientifically • To give the ability of determining progressive steps to reach new synthesis
Learning Outcomes and Competences	To gain ability for innovations in scientific approach or to develop a new scientific method or to apply obvious method to a new field.
Textbook and /or Reference	All the references related to the study.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		

Instructors	The supervisor

Week	**Subject**
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7001010 TERM PROJECT									**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	70		300			68	438	0	17.5

Language	Turkish		
Compulsory / Elective	Compulsory		
Prerequisites	Assignment of the supervisor		
Course Contents	A theoretical and practical assay in which technical know how gained in professional discipline are applicable		
Course Objectives	To acquaint in a certain field and to teach how to apply.		
Learning Outcomes and Competences	Getting an ability to apply the knowledge obtained during education		
Textbook and /or Reference	All the references related to the study.		
Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		
Instructors	The supervisor		

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8000010 DOCTORAL QUALIFYING EXAMINATION								**MECHANICAL ENGINEERING DEPARTMENT**	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	400					38	438	0	17.5

Language	Turkish		
Compulsory / Elective	Compulsory		
Prerequisites	To complete the minimum course credit		
Course Contents	The written and oral exams on basic subjects and related fields of the PhD thesis work		
Course Objectives	To check the qualification on basic subjects and related fields of the PhD thesis work		
Learning Outcomes and Competences	To have the qualification on basic subjects and related fields of the PhD thesis work		
Textbook and /or Reference	All the references related to the study.		
Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		
Instructors	Qualification committee		

Week	**Subject**
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8000010DD SPECIAL TOPICS in MS									**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42	150		30		28	250	0	10
Language	Turkish								
Compulsory / Elective	Compulsory								
Prerequisites	Assignment of the supervisor								
Course Contents	Basic concepts and applications related to the thesis work								
Course Objectives	• To give the general knowledge related to the thesis work • To develop the ability of analytical thinking								
Learning Outcomes and Competences	• To have the general knowledge • To have the ability of making plans for the research work								
Textbook and /or Reference	All the references related to the study.								

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		

Instructors	The supervisor
Week	**Subject**
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8500010 PROGRESS IN THESIS							MECHANICAL ENGINEERING DEPARTMENT		
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	40	100				48	188	0	7.5

Language	Turkish		
Compulsory / Elective	Compulsory		
Prerequisites	Passing the qualification exam		
Course Contents	Developing the research work		
Course Objectives	To analyse the results obtained according to the work plan of PhD studies and make the work plan for the next period and contributing to the direction of the PhD work.		
Learning Outcomes and Competences	To get an ability of making work plans on the basis of research objective and evaluating the results and presentation.		
Textbook and /or Reference	All the references related to the study.		
Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		
Instructors	Thesis committee		

Week	**Subject**
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9000010DD SPECIAL TOPICS in PhD									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42	150		30		28	250	0	10

Language	Turkish		
Compulsory / Elective	Compulsory		
Prerequisites	Assignment of the supervisor		
Course Contents	Basic concepts and applications related to the thesis work		
Course Objectives	• To give the general knowledge related to the thesis work • To develop the ability of analytical thinking		
Learning Outcomes and Competences	• To develope the ability of analytical thinking • To get the ability of evaluation, data analysis and making written/oral presentation		
Textbook and /or Reference	All the references related to the study.		
Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams		
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam		
Instructors	The supervisor		

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MM 502 FINITE ELEMENT ANALYSIS							MECHANICAL ENGINEERING DEPARTMENT		
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42		40	40	20	46	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Discretization of the domain. Interpolation polynomials. Simplex, complex, and multiplex elements. Interpolation polynomials in terms of global and local coordinates. Formulation of element characteristic matrices and vectors. Variational approach. Assembly of element matrices and vectors and derivation of system equations. Assemblage of element equations. Incorporation of the boundary conditions. Solution of finite element equations. Higher-order and isoparametric formulations. Numerical integration. Applications to static and dynamic analysis of solids and structures, steady and unsteady heat transfer and fluid mechanics problems.
Course Objectives	Formulation and description of the solution steps of the engineering problems by learning of the finite element method.
Learning Outcomes and Competences	General review of the numerical methods, learning of the solution techniques of the finite element method,preparation of the engineering problems to be solved in FEM, conversion of these system of equations to the computer environment.
Textbook and /or Reference	Text Book: J.N.Reddy, An Introduction to the Finite Element Method, , McGraw-Hill.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks	X	10
	Projects	X	25
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	25

Instructors	Assist. Prof. Dr. Ezgi GÜNAY
Week	**Subject**
1	İntegral formulations and general knowledge about variational
2	Boundary value problems and boundary conditions
3	Weak formulations,potential energy functions in one dimensional problems
4	Weak formulation, potential energy functional in two dimension
5	One dimensional problem definitions in finite element methods
6	Bending on beams
7	Truss systems
8	Final projects-Problem definitions and descriptions for solution procedures
9	Interpolation functions and two dimensional problems in finite element method
10	Triangular elements, plane elasticity problems
11	Plane elasticity problems
12	Torsion problem
13	Mesh generation, numerical integration
14	Representation of the final projects

MM 503 ADVANCED DYNAMICS					MECHANICAL ENGINEERING DEPARTMENT				
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	42				46	100	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Hamilton's principle. Generalized variables. Lagrange's equation. Rigid body dynamics and systems with gyroscopic effects. Gyroscopic effects on spinning shafts and critical speeds. Gyro-compass, inertial navigation. Vibration of systems with time varying and non-linear characteristics.
Course Objectives	Teaching how to obtaining sysytem equation and Rigid body dynamics and systems with gyroscopic effects
Learning Outcomes and Competences	Learning how to apply Hamilton's principle. Generalized variables. Lagrange's equation to dynamic systems.
Textbook and /or Reference	Advanced Engineering Dynamics / J. H. Ginsberg / TA 352 G55. 2. Methods of Analytical Dynamics / L. Meirovitch / QA 846 M45. 3. Analytical Dynamics / H. Baruh / QA 845 B38. 4. Classical Mechanics / H. Goldstein / QA 805 G6. 5. Adv. Dynamics: Modelling and Analysis / D'Souza and Garg / QA 805 D79

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	50
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Prof.Dr.Mehmet EROĞLU, Assoc.Prof.Dr. Şefaatdin YÜKSEL

Week	**Subject**
1	Basic Considerations
2	Particle Kinematics
3	Relative Motion
4	Kinematic of Rigid Bodies
5	Eulerian Angles
6	Eulerian Angles
7	Impulse-Momentum-Work Energy Principles
8	Generalized Coordinates
9	Holonomic and Nonholonamic
10	Hamilton's Principle
11	Lagrange's Equations
12	Further Concepts in Analytical Mechanics
13	Gyroscopic Effects
14	Spinning Shafts

MM 504 ADVANCED SYSTEMS DYNAMICS AND OPTIMAL CONTROL									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30		30	30	86	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	State determined systems. State models of energetic systems. One port mechanical, electrical, fluid and thermal system elements. Multiport transducing elements. Formulation of state equations. Linear graphs. Controllability and observabilitiy. Variational methods in dynamics and control. Stability of linear and nonlinear systems; Liapunov function. Optimal control and the state function of Pontryagin. State function approach to linear system synthesis; Riccati equation, Kalman equation. Modeling & performance indices.
Course Objectives	State determined systems. State models of energetic systems. One port mechanical, electrical, fluid and thermal system elements. Multiport transducing elements. Formulation of state equations
Learning Outcomes and Competences	Learning to Optimal control and the state function of Pontryagin. State function approach to linear system synthesis; Riccati equation and Kalman equation. Modeling and performance indices.
Textbook and /or Reference	1. K.Ogata, "System Dynamics.",Prentice-Hall, 1997. 2. Shearer, Murphy, Richardson,"Introduction to System Dynamics" Addison-Wesley,1972. 3. Rowel,Wormley," Introduction to System Dynamics" Prentice-Hall, 1997. 4. Y.Ercan," Mühendislik Sistemlerinin Modellenmesi ve Dinamiği", 2003

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper	X	10
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Prof. Dr. Mehmet EROĞLU, Yrd.Doç.Dr. Metin U. SALAMCI

Week	**Subject**
1	State Determined Systems
2	Models of Energetic(Physical)SDS
3	Models of Energetic(Physical)SDS
4	Equations of State for Systems of Interconnected Part
5	Causal Graphs and Transfer Functions
6	Controllability, Observability
7	Systen Respance,Matrix Exp.
8	Stability
9	Classical Control Synthesis
10	Controllers,Performance Indexes
11	Optimal Control
12	State Function Pontryagin
13	State Regulators
14	Supplement Observers

MM 505 THEORY OF PLASTICITY					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Principal, normal and shear stresses and strains. Equilibrium equations. Elasto-plastic deformation of rods. Mechanisms of plastic deformations and stability. Plastic deformation of hollow sphere. Elastic flow: Finite deformation rate tensor. Extrusion of plates and strips. Plastic flow on a rigid surface. Mechanical theory of creep. Dynamical resistance of materials. Stress-strain curves for dynamic loadings. Theory of impact loadings. Elasto-plastic waves in rods. Reflection of longitudinal elastic waves. Impact of a rod on stationary rigid target. Penetration. Mechanical behavior under oscillatory loads. Torsional vibrations of rods. Transverse vibrations of rods. Fatigue & fatigue failures.
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	1. Lublineer, J., (1990). Plasticity Theory. MacMillan. 2. Chakraberty, J., (1999). Apllied Plasticity. Springs.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM

Week	**Subject**
1	Principal,Normal and Shear Strarases and Strain
2	Equilibrum Equations.Elasto-Plastic Deformation of Rods.
3	Mechanisms of Plastic Deformations and Stability.Plastic Deformation of a Hollow Sphere
4	Plastic Flow:Finite Deformation Rate Tensor
5	Extrusion of Plates and Strips.Plastic Flow on aRigid Surface
6	Mechanical Theory of Creep.Dynamical resistance of Materials
7	Stres-Strain Curve:for Dynamic LoadingsTheory of Impact Loadings
8	Elasto-Plastic Waves in Rods.Reflection of Longitudinal elastic Waves
9	Impact of a Rod on a Stationary Rigid Target
10	Penetration
11	Mechanical Behaviour Under Oscillatory Loads
12	Torsional Vibrations of Rods
13	Transverse Vibrations of Rods
14	Fatigue and Fatigue Failures

MM 507 ADVANCED STRENGTH OF MATERIALS									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Introduction to plane elasticity teory, equilibrium equations, kinematic relations, compatibilty, symmetrical bending of circular plates, beams on elastic foundations, membrane stresses in thin shells, torsion of prismatic bars.
Course Objectives	To teach the students the more complex Mechanics of materials problems, by using the basic equtions of elasticity.
Learning Outcomes and Competences	Understanding special topics of mechanics of materials that are not covered in the elemantary mechanics of materials course.
Textbook and /or Reference	1. Ansel C. Uğural and Saul K. Fenster, Advanced Strength and Applied Elasticity, third edition, Prentice Hall Inc., USA, 1989.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Müfit GÜLGEÇ
Week	**Subject**
1	Introduction to Plane Elasticity Teory
2	Plane Elasticity Theory:Equilibrum Equations
3	Plane Elasticity Theory:Kinematic Realations,Compatibility ....
4	Introduction to Plane Theory:General Equations
5	Introduction to Plane Theory:Rectangular Plates,Boundary Conditions
6	Axisymmetrically Loaded Circular Plates
7	MT-I,Solution of Some Parctical Problems About Circular Plates
8	Beams on Elastic Foundations
9	Semi-Infinite And Infinite Beam Problems
10	Introduction to Shell Theory: General Equations
11	Membrane Stresses in Thin Shells
12	Torsion of Prismatic Bars:Governing Equations
13	MT II,Prandtl and Membran Analogy
14	Torsion of-walled Members of Open and Multiply Connected Sections

MM 509 POWDER METALLURGY PRODUCTION PROCESSES									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	36	6				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Metal powder production techniques: Atomization, chemical, electrolytic and milling processes. Characterization of metal powders. Powder compaction: pressing, HIP/CIP, rolling, extrusion, injection molding. Sintering: stages, furnaces and gases. Full density processes, plasticity theory for porous materials. Mechanical properties of powder metallurgy processed materials. Powder systems and applications.
Course Objectives	To introduce; powder metallurgy techniques which are accepted as high tech manufacturing processes, powder production processes and powder properties, P/M finished parts and their application areas.
Learning Outcomes and Competences	To know powder metallurgy techniques and their applications To define, formulize and solve the engineering problems To design, perform and evaluate experiments To apply the knowledge of mathematics, science an engineering
Textbook and /or Reference	1. Randall M. German, (1984), Powder Metallurgy Science, Metal Powder Industries Federation (MPIF), 2nd edition, New Jersey (NJ), USA. 2. Leander F. Pease III and William G. West, (2002), Fundamentals of Powder Metallurgy, MPIF, New Jersey (NJ), USA. 3. Werner Schatt, Klaus-Peter Wieters, (1997) Powder Metallurgy: Processing and Materials European Powder Metallurgy Association, EPMA, UK.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Assist. Prof. Dr. Ibrahim USLAN

Week	**Subject**
1	Introduction to Powder Metallurgy Production Process
2	Metal Powder Production Techniques:Milling and Electrolytic Process
3	Metal Powder Production Techniques:Cehemical,Gas and Water Atomization Process
4	Metal Powder Productions Techniques:Döner Disk ve Döner Elektrot Atomizasyonu
5	Characterization of Material Powders:Particle Sizing
6	Characterization of Material Powders:Shape,Surface Area,Flow Rate
7	Characterization of Material Powders:Gren Density,Gren Strength,Compressibility
8	Powder Compaction:Pressing,Hot and Cold Isostatic Pressing
9	Powder Compaction:Rolling,Extrusion,Powder injection molding.
10	Sintering,Diffüsion:Sinterleme Aşamaları,Fırınlar ve Gazlar
11	Full Density Processes:Liquid Phase Sintering,Infiltration,Mechanical Consolidation
12	Plasticity Theory of Porous Materials
13	Mechanical Properties of Powder Metallurgy Processed Materials
14	Powder Systems and Applications

MM 510 FLUID POWER CONTROL									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42					146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Theory and design of hydraulic and pneumatic control systems and components, and their applications. Pressure-flow relationships for hydraulic and pneumatic valves. Valve configurations. Valve operating forces. Linkage, force, load pressure and dynamic pressure feedback in valves. Closed loop systems for the control of pressure, flow, speed, position, force and other quantities. Hydraulic and pneumatic components. Application of basic principles to component and system design.
Course Objectives	The objective of the course is to give the students the theory of fluid power control systems.
Learning Outcomes and Competences	The students will be able to analyse, design and apply a fluid power control system.
Textbook and /or Reference	1. Yücel ERCAN, "Akışkan Gücü Kontrolü Teorisi", Gazi Üniversitesi yayın No:206, Ankara, 1995. 2. John F. Blackburn, Gerhard Reethof, J. Lown Shearer, "Fluid Power Control" The M.I.T. Press 1960. 3. Herbert E. Merrit, "Hydraulic Control Systems", John Wiley, 1967 4. D. McCloy, H.R.Martin, "The Control of Fluid Power", Longman, 1973

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	60
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Dr. Ömer KELEŞ

Week	**Subject**
1	Introduction
2	Control Valves
3	Characteristic of Hydrodinamic Valves
4	Characteristic of Hydrodinamic Valves
5	Characteristic of Pneumatic Valves
6	Characteristic of Pneumatic Valves
7	Valve Selection
8	Valve Operating Forces
9	Modeling of Control Valves
10	Modeling of Control Valves
11	Closed Loop Electrohdyrodinamic Control
12	Closed Loop Electrohdyrodinamic Control
13	System Design
14	System Design

MM 512 FRACTURE MECHANICS									MECHANICAL ENGINEERING DEPARTMENT
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	42					146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Griffith crack theory, stress analysis of cracks, design philosophy, energy approach method, stress analysis approach method, crack-tip plastic zone size estimation, Plane-strain fracture toughness, plane-stress fracture toughness, plane-strain fracture toughness testing, fracture toughness of engineering alloys, toughness determination from crack opening displacement measurement, Fracture toughness and elastic plastic analysis with the J-integral. Fracture test methods: impact energy-fracture toughness correlations. Microstructural aspects of fracture toughness, environment-assisted cracking, cyclic stress-controlled fatigue, cyclic stress-controlled fatigue, fatigue life estimations, fatigue crack propagation, corrosion fatigue, stress-corrosion cracking.
Course Objectives	A major objective of fracture mechanics is to study the load- carrying capacity of structures in the presence of initial defects where a dominant crack is assumed to exist. Thus a new design philosophy is introduced by fracture mechanics as opposed to the use of the traditional fracture criteria.
Learning Outcomes and Competences	Learning the importance of fracture mechanics approach in analyzing the fracture of solids.
Textbook and /or Reference	1.Fracture Mecanics, E.E.Gdoutos, Kluwer Academic Publsher, Netherlands (1993) 2.Strength &Fracture of Engineering Solids, David K. Felbeck, Anthony G. Atkins, Prentice Hall,Inc.,(1996). 3.Deformation & Fracture Mechanics of Engineering Materials, R.W. Hertzberg, John Wiley & Sons,Inc. (1989).

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof.Dr.Rafet ARIKAN

Week	**Subject**
1	Historical Review,The Significance of Fracture Mekanics,The Griffith Energy Balance Approach
2	The Stres Intensity Approach
3	Determination of The Plastic Zone Size
4	Lineer Elastic Fracture Mekanics:The Elastic Stres Field Equations
5	Fracture Toughness:The Plane Strain Fracture Toughness(KIC),Plane Stres Fraction Toughness
6	Determination of Stres Intensity Factors from Compliance
7	First Midterm
8	Elastic-Plastic Fracture Mechanics
9	The J-Integral Method
10	Other Fracture Test Methods:Impact Energy-Fracture Toghness Correlations
11	Microstructural and Environmental Effects on Fracture
12	Fatigue Crack Propagation and Fatigue Life Calculations
13	Fatigue Crack Propagation and Fatigue Life Calculations
14	Environment-Assisted Fracture;Corrosion Fatigue,Stres-Corrosion Cracking

MM 515 MATHEMATICAL PLASTICTY THEORY	MECHANICAL ENGINEERING DEPARTMENT

Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Physical principles. Yield criterion. Plastic stress-strain relations. Two measures for strain-hardening. Exremum principles. Plastic potential. Elasto-plastic problems. Plane strain. Plane deformation problems and its applications to shear lines and elasto-plastic wave propagation. Geometrical effects. Anisotropic plasticity.
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by the knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	1. Khan, A.S. and Hnang, S., (1995). Continuum Theory of Plasticity. John Wiley. 2. Maugin, G.A., (1992). The Thermomechanics of Plasticity and Fracture. Cambridge. 3. Lubarda, V.A., (2001). Elastoplasticity Theory. CRS.

Assessment Criteria		If any, mark as (X)	Percentage (%)
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM

Week	Subject
1	Physical Principles
2	Yield Criterion
3	PlasticStress-Strain Relations
4	Two Measures for Strain-Hardining
5	Extramum Principles
6	Plastic Potential
7	Elasto-Plastic Problems
8	Elasto-Plastic Problems
9	Plaine Strain
10	Plane Deformation Problems
11	Plane Deformation Problems Applied to Shear Lines and Elasto-Plastic Wave Propagation
12	Plane Deformation Problems Applied to Shear Lines and Elasto-Plastic Wave Propagation
13	Geometrical Effects
14	Anisotropic Plasticity

MM 517 MECHANISC OF COMPOSITE MATERIALS										MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Fundamentals of linear anisotropic elasticity. Constitutive equations for the macroscopic behavior of laminated composites. Continuum theory of fiber-reinforced composites. Analysis of internal fields in heterogeneous medium. Wave propagation and dynamic effects in composites. Effective- stiffness theory considerations. Introduction to the theory plastic and viscoelastic composites.
Course Objectives	
Learning Outcomes and Competences	
Textbook and /or Reference	1. Daniel M. Isaac, Ishai Ori, (1994), Engineering Mechanics of Composite Materials, Newyork,Oxford Unıversity Press. 2. Jones M. Robert, (1975), Mechanics of Composite Materials, USA,Taylor and Francis Boks. 3. Hyer M.W.,(1998), Stress Analysis of Fiber- Reinforced Composite Materials, Singapure, McGraw-Hill.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	20
	Quizzes		
	Homeworks		
	Projects		
	Term Paper	X	10
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Mahmut ÖZBAY
Week	**Subject**
1	Fibers and Matrices
2	Fundamentals of Linear Anisotropic Elasticity
3	Stres-Strain Relations for Orthotropic Materials
4	Constitutive Equations for The Macroscopic Behaviour of laminated composites
5	Stres-Strain Relations for Plane Stress
6	Plane-Stress Stres-Strain Relations in a Global Coordinate Systems
7	Continuum Theory of Fiber-Reinforced Composites
8	Analysis of Internal Fields in Hetrejeneous Medium
9	Analysis of Internal Fields in Hetrejeneous Medium
10	Wave Propagation and Dynamic Effects in Composites
11	Wave Propagation and Dynamic Effects in Composites
12	Effective-Stiftness Theory of Viscoelastic Composites
13	Introduction to Theory of Viscoelastic Composites
14	Introduction to Theory of Plastic Composites

MM 519 NUMERICAL METHODS IN FLUID MECHANICS					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	24	18				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Classification of fluid flow phenomena. Fundamental flow equations. Advantages and disadvantages of numerical methods. Basic steps of numerical methods. Discretization methods. Numerical properties of discretization schemes. Solution of linear algebraic equation systems. Solution of convection-diffusion problems using control volume formulation. Computational methods for incompressible Navier-Stokes equations: Primitive and vorticity based methods, SIMPLE, SIMPLER, SIMPLEC and PISO algorithms. Application of finite difference method to boundary layer type flows. Finite element method and its application to flow problems.
Course Objectives	To teach the numerical methods used for the solution of flow problems and develop computer programs employing these method.
Learning Outcomes and Competences	After completion of the course, students are expected to be able to apply basic numerical methods to the flow problems with appropriate boundary and initial conditions; develop algorithms and programs in a computer language and interpret the numerical results.
Textbook and /or Reference	1. S. V. Patankar, 1980, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation. 2. H. K. Versteeg and W. Malalasekera, 1995, An Introduction to Computational Fluid Dynamics, Prentice Hall. 3. D. A. Anderson, J. C. Tannehill, Richard H. Plecther, 1984,Computational Fluid Mechanics and Heat Transfer.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	25
	Quizzes		
	Homeworks	X	15
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Haşmet TÜRKOĞLU
Week	**Subject**
1	Introduction:Definitions,methods of analysis,fundamental laws.
2	Introduction:Governing Equations,conservation of mass,momentum and energy equations
3	Discretization Methods:Finite Difference,Finite volume,Finite element and spectral methods
4	Solution of Linear Algebraic Equations:Direct methods,Gauss elimination method,Gauss Jordan elimination method,iterative methods.
5	Heat Conduction:One-Dimensional unsteady heat conduction equation,explicit,implicit an Crank Nicholson formulations
6	Heat Conduction:Two and Three dimensional heat Conduction equations
7	Heat Conduction:Solution of algebraic equations,overrelaxation and Underrelaxation
8	Midterm Exam I
9	Convection diffusion Equation:Steady,one dimensional convection diffüsion equation,exact
10	Convection diffusion Equation:General Formulation,comparison of Different methods
11	Convection diffusion Equation:Two-and three dimensioanl flows.
12	Solution of two-aand thre e dimensioanl Navier-stokes equations:Primitive Variable method,Sımple and Simler algorithms.
13	Midterm Exam II
14	Solution of Two-Dimensional Navier-Stokes Equation:Stream Function-Vorticity method.

MM 520 RELIABILITY IN MACHINE DESIGN					**MECHANICAL ENGINEERING DEPARTMENT**				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30			40	106	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Reliability, failure in the critical systems, theory of statistics in mechanical design and reliability, distribution functions, steady loading and statistical consideration, variable loading and statistical consideration, wear and statistical consideration, reliability of the critical system and function elements and reliability of system-element.
Course Objectives	To provide backgraund of the methods of probabilistic and statistical analysis that are common in reliability for design. - To provide the development and application of reliability evaluation techniques for design of machine components and systems.
Learning Outcomes and Competences	At the end of the course it is supposed for the student; - having a knowledge of theory for probabilistic mechanical design. - having a knowledge of reliability evaluation of engineering systems. - knowing about machine components design for optimum size. - obtaning the ability of designing for reliability.
Textbook and /or Reference	1. P. Kales "Reliability –For Technology, Engineering and Management", 1998. 2. A. D. S. Carter " Mechanical Reliability", 1986. 3. E. B. Haugen " Probabilistic Mechanical Design" J. Wiley and Sons. 4. R. Billionton " Reliability Evaluation of Engineering Systems", Pitman.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Bedri TUÇ
Week	**Subject**
1	Reliability
2	Failure in the critical systems
3	Theory of statistics in mechanical design and reliability
4	Distribution Functions
5	Distribution Functions
6	Distribution Functions
7	Distribution Functions
8	Steady Loading and statistical consideration
9	Variable Loading and statistical consideration
10	Variable Loading and statistical consideration
11	Wear and Stastical Consideration
12	Wear and Stastical Consideration
13	Reliability of the critical system and function elements
14	Reliability of the critical system and function elements,reliability,reliability of system-element

MM 523 CONTINUUM MECHANICS								MECHANICAL ENGINEERING DEPARTMENT	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Location and identification of a material body. Spatial and material coordinates. Motion and deformation. Deformation gradient and strain tensors. Deformation of material line, area, and volume elements. Invariants of deformation measures and their time rates. Kinematics and kinetics of deformation. Internal forces and Cauchy stress principle. Balance laws for mass, momentum, angular momentum, energy, and entropy production. Local balance laws. Thermodynamic restriction on the behavior of elastic solids and viscous fluids. Constitutive axioms and resulting restrictions on general material behavior
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by the knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	1. Şuhubi, E.S., (1994). Sürekli-Ortamlar Mekaniği (Giriş). İTÜ Fen-Ed. Fak. Yayınları. 2. Dawson, T.H. (1976). Theory and Practice of Solid Mechanics. Plenum.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM

Week	**Subject**
1	Coordinate Systems.Base Vectors.Tensors
2	Deformation gradient and tensor.Tarnsformation of deformation tensor
3	Principal strains.Strain invariants
4	Mation.Material Derivatives of line ,area and Volume elements
5	Material derivates of line,surface and volume integrals
6	Fundamentals laws of continuum mechanics
7	Conservation of mass.Continuity equation
8	Linear Momentum and angular momentum principle
9	Conservation of energy.First Law of Thermodynamics
10	Entrophy.Second Law Of Thermodynamics
11	Local Balance Laws
12	Thermodynamics restriction on the behaviour of elastic solids
13	Thermodynamics restriction on the behaviour of Viscous Fluids
14	Constitutive Equations

MM 524 MOMENTUM AND MASS TRANSFER									**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42				30	24	96	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Mass diffusion in solids, liquids, and gases; transport equations for multicomponent systems; laminar forced and natural convective mass transfer; mass transfer in turbulent flows; interface mass transports. Analogy.
Course Objectives	This course is intended to familiarize the students with the developments in mass transfer phenomena. Emphasis, coefficient under various regimes of and various interphase geometries. To teach application of analogy.
Learning Outcomes and Competences	Understanding of the mass transport phenomena. Applying the equations of mass transfer at the diferent regimes. Understanding analog.
Textbook and /or Reference	1. W.Kays, M. Crawford and B. Weigand, Convective Heat and Mass Transfer, 4th Edn.,McGraw-Hill International Edition, 2005. 2. Skellands, A.H.P., Diffusional Mass Transfer, John Wiley and Sons, 1985.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	28
	Quizzes		
	Homeworks	X	12
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Asst. Prof. Dr. OĞUZ TURGUT

Week	**Subject**
1	Introduction
2	Conservation Principles
3	Fluid Stresses and Flux Laws
4	Differential Equations for the Laminar Boundary Layer
5	Differential Equations for the Laminar Boundary Layer
6	Mass Diffusion in Solids, Liquids and Gases
7	Mass Diffusion in Solids, Liquids and Gases
8	MIDTERM I
9	Convective Mass Transfer: Basic Definitions and Formulation of a Simplified Theory.
10	Convective Mass Transfer: Evaluation of the Mass-Transfer Conductance From the Conserved – Property (P) Equation.
11	Convective Mass Transfer: Evaluation of the Mass-Transfer Conductance From the Conserved – Property (P) Equation.
12	Convective Mass Transfer: Examples for Application of the Smplified Method.
13	Convective Mass Transfer: Examples for Application of the Smplified Method.
14	MIDTERM II

MM 527 COMBUSTION AND COMBUSTION TECHNOLOGY					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Fundamentals of combustion and combustion systems. Fuels and fundamental phases of combustion process. Combustion calculations. Homegenous mixing and combustion of gaseous fuels. Turbulence in tube flow and in free volume. Free jets and jets with rotation. Burner and burner design ignition and combustion processes.Combustion chamber design. Heterogenous combustion of pulverized coal. Pulverisation and combustion systems. Combustion of lump coal.
Course Objectives	To give necessary know ledge to the students on combustion and combustion technology and its applications. To introduce basic properties and importance of combustion systems applications. The aim of the course is to help the development of the national industry. To help the development of the combustion engineering skills of the students.
Learning Outcomes and Competences	To give the related theory and practice the students. Understanding of basic properties of combustion and combustion. Learning the usage of the methods for research, design and development in the analysis of the energy transformation at applications of combustion and combustion technology..
Textbook and /or Reference	1. Combustion Engineering, Borman , G.L., McGraw-Hill 2. Kömür Özellikleri Teknolojisi ve Çevre İlişkileri, Kural, O., İTÜ, Maden Mühendisliği Böl., İstanbul. 3. Yanma ve Yakma Sistemleri ve Hava Kirliliği, Durmaz, A., G.Ü. Makine Müh.Böl., Ankara

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Assist. Prof. Dr. İbrahim ATILGAN
Week	**Subject**
1	Introduction and Fundamental Concepts.
2	Fundamentals of Combustion and Combustion Systems.
3	Fuels and Fundamental Phases of Combustion Process
4	Combustion Calculations.
5	Homegenous Mixing and Combustion of Gaseous Fuels.
6	Turbulance in Tube Flow and in Free Volume.
7	Applications, Midterm Exam I.
8	Free Jets and Jets With Rotation.
9	Burner and Burner Design Ignition and Combustion Processes.
10	Combustion Chamber Design.
11	Combustion of Pulverized Coal.
12	Pulverisation and Combustion Systems.
13	Applications, Midterm Exam II.
14	Heterogenous Combustion of Lump Coal.

MM 528 CONTINUUM MECHANICS II					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Contitutive Equations. Axioms of constitutive theory. Thermo-mechanical materials. Elastic materials. Isotropic elastic materials. Stokesian fluids. Thermo-viscose fluids. Isotropic thermo-elastic materials. Elasticity theory. Linear constitutive equations. Constraints on elastic moduli. Elastic waves in isotropic solids. Fluid mechanics. Linear constitutive equations. Particular classes of motions. Compressible ideal fluids and acoustics. Thermo-elasticity. Isotropic solids. Heat conduction in solids. Thermo-elastics waves. Visco-elasticity. Nonlinear and linear Kelvin-Voigt materials. Maxvell materials. General viscoelastic materials. Functional constitutive equations. Wave propagation. Thermo-viscoelastic fluids.
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by the knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	1. Eringen, A.C., (1980). Mechanic of Continua. Krieges. 2. Eringen, A.C., (1962). Nonlinear Theory of Continous Media. McGraw-Hill. 3. Eringen, A.C., (1972). Continuum Physics, Vol.2. Acad Press.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM

Week	**Subject**
1	Axioms of Constitutive Theory.Thermo – Mechanical Materials.
2	Elastic Materials. Isotropic Elastic Materials.
3	Stokesian Fluids. Thermo – Viscose Fluids.
4	Elasticity Theory. Linear Constitutive Equations.
5	Constraints on Elastic Modul. Elastic Waves in Isotropic Solids.
6	Fluids Mechanics. Linear Constitutive Equations.
7	Particular Classes of Motions.Compressible Ideal Fluids and Acaustics.
8	Thermo – Elastic Waves. Visco – Elasticity.
9	Nonlinear and Linear Kelvin – Voigt Materials.
10	Maxwell Materials.
11	General Viscoelastic Materials.
12	Functional Constitutive Equations.
13	Wave Propagation.
14	Thermo-Viscoelastic Fluids.

MM 529 COMPOSITE MATERIALS						MECHANICAL ENGINEERING DEPARTMENT			
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42					146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Definition and classification of composite materials, dispersion strengthened composites, particulate and fiber reinforced composites, glass-fiber reinforced plastics (GFRP); properties of polymers and reinforcements, production techniques, laminate theory, test methods. Metal matrix composites (MMC); matrix alloys and reinforcements, reactions at the interface of fiber/matrix, production techniques, test methods.
Course Objectives	Teaching how to manage an effective scientific writing and prepare and present it as an effective presentation using various tools.
Learning Outcomes and Competences	Learning to organization of a scientific writing, citing references using a formal format; converting the text to a presentation format, effective use and organization of screen for the presentation.
Textbook and /or Reference	1.Compozite materials, Science and Engineering, 2nd ed.,Krishan K.Chawla, Spring-Verlag New York Inc. (1998). 2.Mechanics of compozite Materials, 2nd ed.,Robert M.Jones,Taylor & Francis Inc.Phi. (1999). 3.Laminar compozites, George H. Staab, Butterworth-Hinemann,Boston (1999). 4.Stress Analysis of Fiber_Reinforced Compozite Materials, M.H.Hyer, McGraw-Hill Inc.,Boston (1998). 5.Principles of Compozite Material Mechanichs, Ronald F.Gibson, McGraw-Hill Book Co.-Singapore (1994)

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof.Dr.Rafet ARIKAN
Week	**Subject**
1	Definition and Classification of Composite Materials: Dispersion/Particle/Fiber Reinforced Composites.
2	Fibers Reinforced Plastics: Manufacturing of Fibers.
3	Polymeric Materials: Production Methods, Mechanical Behaviour and Properties.
4	Production of Composite Materials.
5	Physical-Chemical Characteristics of Fiber/Matrix Interfaces.
6	Mechanical Properties of Composites.
7	First Midterm.
8	Lamination Theory: Anisotropic and Orthotropic Materials.
9	Stress – Strain Behaviour of Anisotropic and Orthotropic Materials.
10	Lamina Analysis (Plane stress analysis), Laminate Analysis.
11	Thermal and Hygral Behaviour of Lamina.
12	Mechanical Test Methods for Lamina
13	Metal Matrix Composites: Production, Properties and Test Methods.
14	Second Midterm.

MM 530 ACOUSTIC AND WAVE MECHANICS							MECHANICAL ENGINEERING DEPARTMENT		
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish		
Compulsory / Elective	Optional		
Prerequisites	-		
Course Contents	Terminology of acoustics, characteristics of waves, wave equation and its different solution techniques. Standing waves, specific acoustic impedance, energy density of plane waves, acoustic intensity, transmission phenomena, reflection. Spherical acoustic waves, harmonic spherical waves, spherical radiation from a simple source, intensity distribution. Radiation from line and plane sources. Case studies.		
Course Objectives	Introduction to acoustic and wave propagations		
Learning Outcomes and Competences	Understanding the terminology of acoustics and basic wave mechanics.		
Textbook and /or Reference	1. Bies, P. A.; Hansen, C.H., Engineering Noise Control. Unwin-Hyman. 1988. 2. Kinsler, L.E; Frey, A. R., Fundamentals of Acoustics. 3rd. Ed. John&Wiley, 1982.		
Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60
Instructors	Prof. Dr. Nizami AKTÜRK		

Week	**Subject**
1	Terminology of acoustic
2	Characteristics of waves
3	Derivation of wave equation
4	Solution of wave equation
5	Standing waves
6	First midterm
7	Acoustic intensity
8	Transmission phenomena
9	Reflection
10	Spherical acoustic waves
11	Intencity distribution
12	Second midterm
13	Case studies
14	Case studies

MM 531 APPLIED ELASTICITY									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Analysis of Stress;. Stress and stress state at a point,. Principal stresses,. Equations of equlibrium,. Boundary conditions. Analysis of Strain; Strain and strain state at point, Transformation of strain components, Compatability Equations. Stress-strain Relations; Generalized Hooke's Law, Formulation of elasticity problems, Strain energy, Failure Criteria. Plane Problems of Elasticity; General Theory of Plane Elasticity, Plane strain and generalized plane strain, Plane stress & generalized plane stress, Cartesian Coordinates. Problems in Polar Coordinates; General formulation, Thick-walled cylinders, Shrink and force fits, Rotating cylinders & discs, Thermal stresses, Non-axisymmetric problems, Concentrated loads-Green's function
Course Objectives	To teach the students solution of a Plane Elasticity problems in Cartesian and Polar Coordinate systems by using basic equations and necessary boundary conditions
Learning Outcomes and Competences	Understanding the solution method of a plane elasticity problem and using necesary elasticity equations and boundary conditions.
Textbook and /or Reference	1. Timoshenko, S.P., " Theory of Elasticity ", McGraw Hill Book Co., Inc. 2. Wang, C. "Applied Elasticity" , McGraw Hill Book Co., Inc. 3. Sokolnikoff, I. S., "Mathematical Theory of Elasticity ", McGraw Hill Book Co., Inc.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Müfit GÜLGEÇ

Week	**Subject**
1	Stress Analysis; Stress State at a Point, Principal Stresses.
2	Stress Analysis; Equilibrium Equations, Boundary Conditions
3	Strain Analysis; Strain State at a Point, Transformation Of Strain Compatability Eqn's.
4	Stress-Strain Relations: Hooke's Law , Strain Energy.
5	Plane Elasticity Problems: Formulation of Elasticity Problems, Plane Stress and Strain Problems.
6	Plane Elasticity Problems in Cartesian Coordinates.
7	1. MT. Stress Function, Thermal Stress Problems.
8	Plane Elasticity Problems in Polar Coordinates.
9	Stress Analysis in Thick-Walled Cylinders.
10	Shrink Fit Problems.
11	Rotating Shafts and Disks
12	Thermal Stress Problems.
13	2. MT. Wedge Problems.
14	Concentrated Force and Green's Function.

MM 532 CO-GENERATION POWER PLANTS AND DISTRICT HEATING COOLING SYSTEMS	**MECHANICAL ENGINEERING DEPARTMENT**

Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Formation of air pollution and related definitions. Fuels, emissions and emission formation mechanisms. Environmental aspects of air pollution. Legal aspects of air pollution. Air pollution control acts and their applications. Technical aspects of air pollution. Air pollution control technologies. Internal and external emission control methods .Environmental chimney design. Measurement and analyses aspect of air pollution. Emission and imission measurements. Flue gas purification applications. Flue gas dust, $SO2$, NOx purification systems. Solid waste problems. Vehicle emission control systems.
Course Objectives	To describe the basic approaches used for analyses, design and optimization of air pollution control systems. To explain the engineering approaches to system design and operation. To teach and apply the economical and environmental analyses to the air pollution control systems.
Learning Outcomes and Competences	Understanding of the basic characteristics of air pollution control systems. Learning and applications of approaches and methods used to to analyses and design of air pollution control systems. Interpret the results of solutions.
Textbook and /or Reference	1 Stern,A.C. Engineering Control of Air Pollution. Academic Pres.1977. 2 Durrmaz, A, Y. Ercan. Yanmadan Kaynaklanan Hava Kirliliğinin Kontrolu.1987. 3 Durmaz , A. Kömürün Yanması. Kömür, Özellikleri,Teknolojisi ve Çevre İlişkileri, İTÜ,1998.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Ali DURMAZ

Week	**Subject**
1	Type of Energy, Energy Sources and Energy Efficiency.
2	Importance of Co-generation, District Heating – Cooling.
3	Economical Analyses Related to Energy Efficiency, Enviromental Control.
4	Fossil, Nuclear, Solar Fuels, Combustion , Combustion Systems.
5	Heat Generators, Boilers, Nuclear Reactors, Solar Collector.
6	Energy Conversion Processes and Thermal Power Plant.
7	1. MT. Steam Cycle Thermal Power Plants.
8	Gas Cycle Heat Power Plants, Re-frigeration Cycles.
9	Co – generation of Heat and Power, Steam Cycle Co-generation.
10	Gas Cycle TPP and Gas-Steam Combined Cycle Power Plant.
11	2.MT. Combined Cycle Thermal Power Plants.
12	District Heating Systems, System Structures.
13	Design Approach for District Heating Systems
14	District Cooling Systems.

MM 538 ADVANCED THERMODYNAMICS									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	State equation, property and property relations, incompresible systems, system that they dont react, air-steam mixtures, phase change and chemical equilibrium, reaction, reaction rate and combustion process, minimization and equilibrium of irreversibilities, calculation of exergy, application of air-water vapor mixtures, equilibrium compositions, modern power and refrigeration systems, computer programs for modelling and optimization.
Course Objectives	To teach basic principles of advanced thermodynamics. To train students to identify, formulate and solve enginering problems in advanced thermodynamics. To teach aplication of second law analysis for advanced thermodynamic systems.
Learning Outcomes and Competences	Gaining the ability to use thermodynamic terminology and advanced concepts. Learning the methods to determine and calculate the appropriate energy, mass transfersand entropy generation to solve steady and transient system applications. Learning the advanced methods to apply the concepts of irreversibilty, availability and efficiency to various systems.
Textbook and /or Reference	Bejan, J. (1997). Advanced Engineering Thermodynamics. John Wiley Press. Öztürk A. (1998).Çözümlü Problemlerle Termodinamik. İstanbul. Büyüktür, A. R., (1995). Termodinamik. Birsen Yayınevi. Cilt 1 ve Cilt 2.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Principles and Examples
Week	**Subject**
1	Property Relations (Transformations, Jacobians, Stability Criteria)
2	
3	Equation of State for Simple Substances.
4	Applied Statistical Thermodynamics for Property Estimation.
5	Midterm Examination I
6	Non-reacting Mixtures and Applications.
7	Chemical Equilibrium, Reaction Rate.
8	Entropy Generation Minimization.
9	Exergy Analysis
10	General I-D Compressible Flow in Ducts, Applications.
11	Midterm Examination II.
12	Conservation Equations with Reaction, Homogenous Combustion.
13	Premixed and Diffusion Flame.
14	Combustion of Rocket Fuels.

MM 539 INTRODUCTION TO FLUIDIZED BED COMBUSTION									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Principles of fluidization, bubbling and circulating fluidized beds, heat transfer in fluidized bed, combustion in fluidized bed. General approach in fluidized bed type boilers. New developments in fluidized bed technology. Problems of fluidized bed combustors.
Course Objectives	To provide knowledge about design of fluidized bed systems by explaining the principles and the main parts of the system
Learning Outcomes and Competences	To recognize the fluidized bed systems and to comprehend the boilers with this technology used to produce energy.
Textbook and /or Reference	1. Fluidization Engineering, D.Kunii and O.Levenspiel, Wiley, New York, ISBN0-88275-542-0, 1983 2. Circulating Fluidized Bed Boilers, P. Basu and S.A.Fraser, Butterworth-Heinemann,USA, ISBN 0-7506-9226-X, 1991

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	20
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	50

Instructors	Assist. Prof. Dr. Hüseyin TOPAL
Week	**Subject**
1	Principles of Fluidization.
2	Types of the Fluidization.
3	Hyrodynamics of Fluidization.
4	Regimes of Fluidization.
5	Bubbling Beds.
6	Fast and Circulating Beds.
7	Combustion Process in Fluidized Beds.
8	Emission Control in Fluidized Bed Combustors.
9	Heat Transfer.
10	Design of Fluidized Bed Boilers (Combustion Chamber)
11	Design of Fluidized Bed Boilers (Heat Transfer Areas)
12	Design of Fluidized Bed Boilers (Combustion Control)
13	Problems of Fluidized Beds.
14	Problems of Fluidized Beds.

MM 540 AIR POLLUTION AND CONTROL TECHNOLOGIES					**MECHANICAL ENGINEERING DEPARTMENT**				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Formation of air pollution and related definitions. Fuels, emissions and emission formation mechanisms. Environmental aspects of air pollution. Legal aspects of air pollution. Air pollution control acts and their applications. Technical aspects of air pollution. Air pollution control technologies. Internal and external emission control methods .Environmental chimney design. Measurement and analyses aspect of air pollution. Emission and imission measurements. Flue gas purification and applications. Flue gas dust, SO2, NOx
Course Objectives	To describe the basic approaches used for analyses, design and optimization of air pollution control systems. To explain the engineering approaches to system design and operation. To teach and apply the economical and environmental analyses to the air pollution control systems.
Learning Outcomes and Competences	Understanding of the basic characteristics of air pollution control systems. Learning and applications of approaches and methods used to to analyses and design of air pollution control systems. Interpret the results of solutions.
Textbook and /or Reference	1 Stern,A.C. Engineering Control of Air Pollution. Academic Pres.1977. 2 Durrmaz, A, Y. Ercan. Yanmadan Kaynaklanan Hava Kirliliğinin Kontrolu.1987. 3 Durmaz , A. Kömürün Yanması. Kömür, Özellikleri,Teknolojisi ve Çevre İlişkileri,İTÜ,1998.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Ali DURMAZ

Week	**Subject**
1	Formation of Air Pollution, It’s Environmental Effects.
2	New Developments Related to Combustion and Emission Control.
3	Air Pollution Control Mechanisms and Systems.
4	Legal Aspects of Emission – Imission Control.
5	Technical Aspects of Emission – Imission Control.
6	Internal and External Emission Control Techniques.
7	Midterm I. Environmental Chimney Design.
8	Emission Measurements and Their Application.
9	Imission (air pollution) Measurements.
10	Emission Distribution Modeling, Air Pollution Contribution Value.
11	Particulate Emission Control Systems.
12	SO2 Emission Control Systems.
13	Midterm II. NOX Emissions Control Systems.
14	CO2 Control Systems, Control of Vehicle Emission.

MM 541 INDUSTRIAL AIR CONDITIONING								MECHANICAL ENGINEERING DEPARTMENT	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42				30	24	96	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Basic definitions, summer and winter air-conditioning, refrigerants, load calculations and distribution; fan, duct design and diffusion apparatus for producing comfort. Air-conditioning methods and equipment, control. Selection of units for the design work, methods of development studies, air conditioning industries.
Course Objectives	This course is intended to familiarize the students with the air-conditioning systems, and their calculations.
Learning Outcomes and Competences	Understanding of the air-conditioning systems.
Textbook and /or Reference	1. "Heating and Air Conditioning of Buildings", D.R. Oughton and S. Hodkins, 9th Edn., Butterworth and Heinemann, 2002. 2. Air Conditioning Engineering, W.P. Jones, 5th Edn., Butterworth and Heinemann, 2001.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	28
	Quizzes		
	Homeworks	X	12
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Asst. Prof. Dr. Oğuz TURGUT
Week	**Subject**
1	Basic definitions
2	Summer and winter air-conditioning
3	Refrigerants
4	Load calculations and distribution
5	Load calculations and distribution
6	Fan, duct design and diffusion apparatus for producing comfort
7	Air-conditioning methods and equipment control.
8	Air-conditioning methods and equipment control.
9	Midterm I
10	Selection of units for the design work
11	Selection of units for the design work
12	Methods of development studies
13	Air conditioning industries
14	Midterm II

MM 542 TRIBOLOGY									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30			40	106	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Quality of contacting interfaces. Friction of dry surfaces. Factors affecting friction and theories of friction. The interface temperature and oxide formation during unlubricated sliding. Mechanisms of wear: Adhesive, abrasive, corrosive, fatigue and fretting wear types. Wear measurement. Factors affecting wear and theories of wear. Lubricants and their properties. Solid film and boundary layer lubrications. Hydrostatic and hydrodynamic bearings. Industrial applications of tribology.
Course Objectives	It is aimed to give the theory of friction, wear and lubrication. Composing base knowladge for choosing tribo-systems and system's elements, the system calculation and design.
Learning Outcomes and Competences	- Recognize friction, wear and lubrication; lubricants and their characteristics, viscosity, the effects of temperature and pressure, additives. - Recognize the lubrication theory, form of load-carrying films and Reynold's differential equation. - Recognize the sliding bearings; define the types and load carrying ability and calculation of bearing temperature of hydrodynamic thrust and journal bearing and hydrostatic thrust bearing.
Textbook and /or Reference	1. G. W. Stachowiak, A. W. Batchelor "Engineering Tribology", 2000. 2. J. Halling "Principles of Tribology", 1983. 3. T. A. Stolarski "Tribology in Machine Design", 2000.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Bedri TUÇ

Week	**Subject**
1	Quality of Contacting Interfaces and Friction of Dry Surfaces.
2	Factors Affecting Friction and Theories of Friction.
3	The Interface Temperature and Oxide Formation During Unlubricated Sliding.
4	Mechanisms of Wear.
5	Mechanisms of Wear.
6	Mechanisms of Wear and Wear Measurement.
7	Factors Affecting Wear and Theories of Wear.
8	Factors Affecting Wear and Theories of Wear.
9	Lubricants and Their Properties.
10	Hydrodynamic Lubrication Theory.
11	Hydrodynamic Lubrication Theory.
12	Hydrodynamic and Hydrostatic Bearings.
13	Hydrodynamic and Hydrostatic Bearings.
14	Industrial Applications of Tribology.

MM 543 NUMERICAL METHODS IN HEAT TRANSFER									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	24	18				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Variational Techniques. Method of weighted residuals. Finite difference and finite volume methods. Finite element method. Characteristics of transport equations; solution methodology; combined heat transfer; advanced turbulence method; compressible reacting systems. Case studies in heat transfer.
Course Objectives	To derive basic equations which are governing numerical methods in heat transfer. To teach and apply basic analytical and numerical methods employed for solution of these equations. To solve engineering problems by commercial software.
Learning Outcomes and Competences	Understanding of the basic characteristics of numerical methods in convective heat transfer and applications of methods. Learning and applications of methods used for the solution of convective heat transfer problems. Interpret the results of solved problems. Solution of engineering problems by commercial software.
Textbook and /or Reference	1. Course notes

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	10
	Quizzes		
	Homeworks	X	10
	Projects	X	10
	Term Paper	X	10
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Nevzat ONUR

Week	**Subject**
1	Introduction to Computational Fluid Dynamics.
2	Fundamental Equations of Momentum and Energy Equations.
3	Fundamental Equations of Momentum and Energy Equations.
4	Overview of Numerical Methods.
5	Finite Difference Method.
6	Clasification of Partial Differential Equations.
7	One Dimensional Boundary Value Problems.
8	Parabolic Partial Differential Equations.
9	Elliptic Partial Differential Equations.
10	Hyperbolic Partial Differential Equations.
11	Scalar Representation of the Navier – Stokes Equations.
12	Incompressible Navier Stokes Equations, Simple and Simplec Algorithms.
13	Incompressible Navier Stokes Equations, Simple and Simplec Algorithms.
14	Introduction to Commercial CFD Softwares and Applications.

MM 546 VISCOUS FLOWS									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	24	18				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	The basic equations; Derivation of the continuity equation, derivation of the equation of motion of a compressible viscous fluid. Derivation of the energy equation. Exact solutions of the Navier-Stokes equations; Couette flow, Poisueille flow, the flow between two concentric rotating cylinders, Stoke's first problem, Stoke's second problem, stagnation flow, flow near a rotating disc, flow in convergent and divergent channels. Laminar boundary layers; derivation of boundary layer equations, flow past a wedge, flow in a convergent channel, derivation of Von-Karman's integral equations, flow past a flat plate, flow past a circular cylinder. Thermal boundary layer in laminar flow; boundary layer simplifications, Coutte flow Poiseuille flow, effect of Prandtl number. Fundamentals of turbulent flow.
Course Objectives	To derive basic equations which are governing viscous fluid flow. To teach and apply basic analytical methods employed for solution of these equations. To solve engineering problems by simplifying governing equations..
Learning Outcomes and Competences	Understanding of the basic characteristics of viscous fluid motion. Learning and applications of methods used to the solution of viscous flow problems. Interpret the results of solved problems.
Textbook and /or Reference	1. Currie, I. G. Fundemental Mechanics of Fluids. McGraw-Hill Book Company. 2. White, F. M. Viscous Fluid Flow. McGraw-Hill Book Company. 3. Schlichting, H. Boundary Layer Theory. McGraw-Hill Book Company.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Nuri YÜCEL, Prof. DR. Ö. Ercan ATAER
Week	**Subject**
1	Fundamentals principles
2	Boundary layer theory
3	Basic equations of boundary layer; continuity and momentum equations
4	Energy equation
5	Exact solutions of the Navier-Stokes equations
6	Flow between two rotating cylinders, Stoke's 1 and 2nd problems
7	1st Midterm examination
8	Two dimensional boundary layer over a plate
9	İntegral and similarity solution of the momentum and energy equations
10	Thermal boundary layer in laminar flow
11	Natural boundary layer; integral solution
12	Natural boundary layer; similarity
13	2nd Midterm examination
14	Effect of thermal stratification

MM 548 FUNDAMENTALS AND APPLİCATION OF FUEL CELLS									**MECHANICAL ENGINEERING DEPARTMENT**	
Semester	**Methods of Education**								**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**		**Credit**	**ECTS credit**
1,2	30	12				146	188		3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Introduction to fuel cells. Advantages, disadvantages, benefits and applications of fuel cells. Basic principles of fuel cells. Electro-chemical processes and generation of electricity. Types of fuel cells. Classification of fuel cells based on temperature and fuels used. Fuels used in fuel cells, their advantages and disadvantages, and properties. Structure and basic parts of fuel cells. Principles, structures and applications of fuel cells using hydrogen. Production, storage and usage of hydrogen in fuel cells.
Course Objectives	To teach the fundamentals of fuel cells. Describe advantages and disadvantages of the fuel cells, describe structure and basic parts of the fuel cells, expalin types of the fuel cells and describe the spplication areas of the fuel cells.
Learning Outcomes and Competences	Understanding of the basic princples and use of fuel cells.
Textbook and /or Reference	Course notes

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Beycan İBRAHİMOĞLU

Week	**Subject**
1	Introduction: advantages, disadvantages, benefits and applications of fuel cells.
2	Basic principles of fuel cells: electro-chemical processes and generation of electricity.
3	Types of fuel cells: classification of fuel cells based on temperature and fuels used.
4	Fuels used in fuel cells: advantages and disadvantages, and properties.
5	Structure of fuel cells: basic components and their functions.
6	Hydrogen based fuel cells: structure and main components.
7	Hydrogen based fuel cells: basic principles.
8	Midterm exam I
9	Hydrogen based fuel cells: applications.
10	Hydrogen production techniques
11	Storage of hydrogen
12	Application of hydrogen based fuel cells
13	Midterm exam II
14	Improment needed for wider application of fuel cells

MM 550 MATHEMATICAL THEORY OF ELASTICITY									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42					146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Cartesian tensors. Stress and strain concepts. Equation of motion. Compatibility equations. Constitutive equations for linear elastic materials. Generalized Hook's law. Plane stress-strain problems. Applications to 2-D elasto-static problems. Elongation torsion, and flexure of rods. Stress concentration. Variational methods. Introduction to thermo-elasticity. Solution of elasticity problems by finite-difference method.
Course Objectives	To produce engineering problem applications and solution techniques by deriving necessary equations peculiar to elastic body in continuous medium
Learning Outcomes and Competences	Differential equilibrium equations, constitution equations and three dimentional stress-deformation correlation; forming in thought system and interpretation of physical dimensions in mind.
Textbook and /or Reference	1. R.B. Ignaczac Hetnarski and Jozef,(2004), Mathematical Theory of Elasticity, USA,Taylor & Francis Books. 2. Chou Peı Chı, Pagano Nicholas J. (1984), Elastisite, Trabzon, KATÜ Basımevi. 3. Timoshenko S., Goodier J.N., (1969), Elastisite Teorisi, İstanbul, Arı Kitapevi Matbaası.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	20
	Quizzes		
	Homeworks		
	Projects		
	Term Paper	X	10
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Mahmut ÖZBAY
Week	**Subject**
1	Cartesian tensors
2	Stress and strain concepts
3	Equations of motion
4	Compatibility equations
5	Consitutive equations for linear elastic materials
6	Generalized Hooke's law
7	Plane stress-strain problems
8	Application to 2-D elasto-static problems
9	Application to 2-D elasto-static problems
10	Elongation, torsion, and flexure of rods
11	Stress concentration
12	Variational methods
13	Introduction to Thermo-elasticity
14	Solution of elasticity problems by finite-difference method

MM 552 NONLINEAR SYSTEMS									MECHANICAL ENGINEERING DEPARTMENT
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Introduction to nonlinear systems. Phase plane analysis. Limit cycle analysis. Piecewise linearization. Series approximation methods. Poincare perturbation method. Krylow and Bogoliubov methods. Stability of non-linear systems. Liapunov theory. Nonlinear system synthesis. The use of nonlinear elements to improve system response, cost, and reliability.
Course Objectives	To analyze behavior and stability of nonlinear systems and then to use the results in order to design engineering systems in a safely manner.
Learning Outcomes and Competences	Understanding the nonlinear systems. Importance of stability and analyzing the nonlinear system in terms of stability. Nonlinear structures in engineering systems and effect of nonlinear components on the performance of engineering systems.
Textbook and /or Reference	1. Khalil, Hassan, K., (1996). Nonlinear Systems. New Jersey: Prentice Hall. 2. Slotine, J.J.E., Li, W., (1993) Applied Nonlinear Control, New Jersey: Prentice Hall.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Assist. Prof. Dr. Metin U. SALAMCI

Week	**Subject**
1	Introduction to nonlinear systems; Second Order Systems.
2	Linearisation. Linear vs. Nonlinear Systems.
3	Phase plane analysis.
4	Phase plane analysis
5	Limit Cycle Teorems; Poincare-Bendixson Teorems.
6	Limit cycle analysis.
7	Series approximation methods. Poincare perturbation method.
8	Krylow and Bogoliubov methods.
9	Stability of nonlinear systems.
10	Lyapunov Method.
11	Lyapunov Method.
12	Lyapunov Method.
13	Frequency response of nonlinear systems.
14	Describing Function Analysis.

MM 554 ANALYTICAL MECHANICS									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Variational principles and Lagrange's equations. Derivation of Lagrange's equations from Hamilton's principle. Differential equations of motion of an arbitrary system of particles. Equations of motion in a potential field. Variational principles and integral invariants. Eulerian angles. Calley-Klein parameters. The Hamilton equations of motion. Canonical transformations and the Hamilton-Jacobi equations. Stability of equilibrium and motions of a system. Small oscillations. Introduction to the Lagrangian and Hamiltonian Formulations for Continuous systems and fields.
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by the knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	1. Meirovitch, L., (1970). Methods of Analytical Dynamics. McGraw-Hill. 2. Fowles, G.R., Cassiday, G.L., Analytical Mechanics, Saunders College Publishing, Sixth Edition, 1999 3. Bose, S., chattoraj, D., Elementary Analytical Mechanics, Alpha Science, 2000

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	50
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	50

Instructors	Assoc.Prof.Dr. Şefaatdin YÜKSEL

Week	**Subject**
1	Variational principles and Lagrange's equations.
2	Derivation of Lagrange's equations from Hamilton's principle.
3	Differential equations of motion of an arbitary system of particles.
4	Equation of motion in a potential field.
5	Variational principles and integral invariants.
6	Variational principles and integral invariants.
7	Eulerian angles.
8	Cayley-Klein parameters.
9	The Hamilton equations of motion.
10	Canonical transformations and the Hamilton-Jacobi equations.
11	Canonical transformations and the Hamilton-Jacobi equations.
12	Stability of equilibrium and motions of a system.
13	Small oscillations.
14	Introduction to the Lagrangian and Hamiltonian Formulations for continuous systems and fields

MM 558 NONTRADITIONAL MACHINING PROCESSES									MECHANICAL ENGINEERING DEPARTMENT
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	32	10			20	126	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	A brief overview and evaluation of nontraditional manufacturing processes and their comparison to traditional manufacturing processes. Classification of nontraditional machining processes according to energy used in material removal and overview of process principles, equipment, machining parameters, process capabilities and applications. Mechanical energy: Ultrasonic machining; abrasive jet machining, water jet machining. Electrochemical energy: Electrochemical machining, electrochemical grinding, electrochemical honing. Chemical energy: Chemical machining. Thermal energy: Electric discharge machining (EDM) wire EDM, laser beam machining, plasma machining.
Course Objectives	To teach important nontraditional machining techniques which are getting popular nowadays.
Learning Outcomes and Competences	To be familiar with application fields, advantages and limitations of the nontraditional methods, and possible use of these techniques in future professional life.
Textbook and /or Reference	G. F. Benedict, Nontraditional Manufacturing Processes, Marcel Dekker, Inc., New York, 1987, ISBN: 0-8247-7352-7. P. C. Pandey and H. S. Shan, Modern Machining Processes, Tata-McGraw Hill Comp., New Delhi, 1988, ISBN: 0-07-096553-6.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper	X	20
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Prof. Dr. Can ÇOĞUN

Week	**Subject**
1	A brief overview and evaluation of nontraditional manufacturing processes and their comparison to traditional manufacturing processes.
2	Classification of nontraditional machining processes according to energy used in material removal and overview of process principles, equipment, machining parameters, process capabilities and applications.
3	Mechanical energy: Ultrasonic machining;
4	Abrasive jet machining,
5	Water jet machining.
6	Electrochemical energy: Electrochemical machining,
7	Electrochemical grinding, electrochemical honing.
8	Chemical energy: Chemical machining.
9	Thermal energy: Electric discharge machining (EDM) wire EDM,
10	Electric discharge machining (EDM)
11	Electric discharge machining (EDM), Wire EDM
12	Laser beam machining
13	Laser beam machining
14	Plasma machining

MM 560 DESİGN OF CONTROL SYSTEMS						MECHANICAL ENGINEERING DEPARTMENT			
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	21	21				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	MM 403 (basic introductory undergraduate course in Automatic Control Systems)
Course Contents	Review of essentials of : time domain analysis, root locus method, and frequency response. Design with PD-, PI-, PID-, phase-lead-, phase-lag-, lead-lag-, notch filter- cotrollers. Design of robust systems. Minor-loop control. State feedback control and pole placement via state feedback.
Course Objectives	Teaching of (Mat-Lab. and/or CC assisted)applications of classical methods for design of conventional controllers (compensators) in time- and frequency-domain.
Learning Outcomes and Competences	Getting equipped with basic understanding of, and competence in designing conventional controllers using classical methods in both domains.
Textbook and /or Reference	1. Kuo, B. C.(1995).Automatic Control Systems, Prentice-Hall, ISBN 0-13-312174-7. 2. Ogata, K.(1997). Modern Control Engineering, Prentice-Hall, ISBN 0-13-261389-1.

Assessment Criteria		If any, mark as (X)	Percentage (%)
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Yasar T. Hondur

Week	Subject
1	Introduction/Scope of the course/objectives and Policy.
2	Time Domain Analysis of Control Systems.
3	Time Domain Analysis of Control Systems.
4	Time Domain Analysis of Control Systems.
5	Time Domain Analysis of Control Systems.
6	Time Domain Analysis of Control Systems.
7	Time Domain Analysis of Control Systems.
8	Frequency Domain Analysis of Control Systems.
9	Frequency Domain Analysis of Control Systems.
10	Frequency Domain Analysis of Control Systems.
11	Frequency Domain Analysis of Control Systems.
12	Frequency Domain Analysis of Control Systems.
13	Frequency Domain Analysis of Control Systems.
14	State Feedback Control Introduction.

MM 561 ADVANCED ROBOTICS								**MECHANICAL ENGINEERING DEPARTMENT**	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Robot applications, Robot Classification Object location, Kinematic Equations: Manipulator Position and Manipulator motion, Homogeneous transformations. Differential relationships, Manipulator Jacobian, Dynamics: Lagrange-Euler and Newton-Euler formulations. Motion trajectories control: Motion control and minimum time control. Force Control.
Course Objectives	Teaching Robot applications, Robot Classification Object location, Kinematic Equations: Manipulator Position and Manipulator motion
Learning Outcomes and Competences	Learning to Manipulator Jacobian, Dynamics: Lagrange-Euler and Newton-Euler formulations. Motion trajectories control
Textbook and /or Reference	1. K.Ogata, "System Dynamics.",Prentice-Hall, 1997. 2.Shearer, Murphy, Richardson,"Introduction to System Dynamics" Addison-Wesley,1972. 3.Rowel,Wormley," Introduction to System Dynamics" Prentice-Hall, 1997. 4.Y.Ercan," Mühendislik Sistemlerinin Modellenmesi ve Dinamiği", 2003

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Mehmet EROĞLU
Week	**Subject**
1	Introduction
2	Robot Arm Kinematics
3	Robot Arm Invers and Direks Kinematics
4	Robot Arm Dynamics
5	Lagrange-Euler formulation
6	Newton-Euler formation
7	Denavit-Hertanberg Representation
8	Link Coordinate System Assıgment
9	Motion Control
10	Type of Control
11	Manipulator Jacobian
12	State-Space Search
13	Robot Languages
14	Test Planning

MM 562 MODELLING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42					146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	An introduction to flexible manufacturing systems (FMS): definitions, characteristics and types of FMS, examples, a detailed analysis of flexibility and performance issues, flexible manufacturing system as discrete event dynamic systems (DEDS): models used to represent TMS and DEDS: petri nets, min max algebra approach, markov chain, finite state machine approach, simulation models. More emphasis will be given to petri-net and min max approaches, comparison of modeling techniques, control of FMS, control architectures, decomposition and coordination issues, disturbance and necessary corrective control actions, real time scheduling methodologies.
Course Objectives	Teaching the modeling and control approaches used in flexible manufacturing systems.
Learning Outcomes and Competences	Understanding the workings of the flexible manufacturing systems; getting familiar and learning the modeling and control techniques used in the FMS.
Textbook and /or Reference	1. Groover, M. P. (2001). Automation, Production Systems, and Computer Integrated Manufacturıng Upper Saddle River: Prentice Hall. 2. Zhou, M. C. And K. Venkatesh (1999). Modeling, simulation, and control of flexible manufacturing systems : a Petri net approach World Scientific: River Edge, N.J.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks	X	10
	Projects	X	10
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	50

Instructors	Assoc.Prof.Dr. MUSTAFA YURDAKUL

Week	**Subject**
1	Introduction to Flexible Manufacturing Systems Definitions, Characteristics and types of FMS
2	Production Lines and Manufacturing Systems; Their Performance Analysis (production rates, utilization, machine quantities.)
3	Performance Analysis of FMS.
4	Performance Analysis of FMS.
5	Performance Analysis of transportation systems (conveyors, AGVs) used in the FM
6	Analysis of FMS as discrete event dynamic systems and definition and analysis of control problem in FMS
7	Control of FMS using Programmable Logic Controllers.
8	Control of FMS using Programmable Logic Controllers.
9	Modelling and Control of FMS using petri nets
10	Modelling and Control of FMS using petri nets
11	Modelling and Control of FMS using petri nets
12	Modelling and Control of FMS using petri nets
13	Analysis of FMS with max-min algebra and other methods.
14	Analysis of FMS with max-min algebra and other methods.

MM 563 RADIATION HEAT TRANSFER								MECHANICAL ENGINEERING DEPARTMENT	
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	32	10				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Fundamentals of thermal radiation, radiative properties of real surfaces, view factors, radiative exchange between gray, diffuse surfaces, radiative exchange between nonideal surfaces, equation of radiative transfer in participating media, the equation of radiative transfer in participating media, radiative properties of molecular gases, particulate and semitransparent media. Approximate and exact solutions for one dimensional media.
Course Objectives	The basic laws of thermal radiation, and the solution of complex thermal radiation problems. The radiative properties of surfaces. Radiative heat exchange between the surfaces.
Learning Outcomes and Competences	Learning the fundamentals of thermal radiation, and complex behavior of radiative surfaces. To learn the approximate and exact solution of one dimensional systems.
Textbook and /or Reference	Modest, M. F., Radiative Heat Transfer, McGraw Hill Book Co., 1993.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Ö. Ercan Ataer

Week	**Subject**
1	Fundamentals of thermal radiation.
2	Radiation properties and electromagnetic wave theory.
3	Radiative properties of real surfaces and view factors.
4	Radiative exchange between grey, diffuse surfaces.
5	Radiative exchange between nonideal surfaces.
6	1st Midterm Examination.
7	Radiative properties of molecular gases.
8	Exact solutions for one-dimensional grey media.
9	Approximate solution methods for one-dimensional media.
10	Radiative properties of semitransparant media.
11	The Zonal method.
12	2nd Midterm Examination.
13	Radiation combined with conduction and convection.
14	The method of spherical harmonics.

MM 564 CONVECTIVE HEAT TRANSFER					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	24	18				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Basic principles and equations. Laminar flows; two-dimensional parallel flows, buoyancy driven flows, thermal boundary layers, fully developed heat transfer. Boundary layer flows; nearly parallel flows, momentum and thermal boundary layers, non-parallel flows. Similarity solutions; similarity transformation, similarity solution of boundary layers. Turbulent flows; algebraic models, one and two-equation models, heat transfer prediction.
Course Objectives	To derive basic equations which are governing convective heat transfer. To teach and apply basic analytical and numerical methods employed for solution of these equations. To solve engineering problems by simplifying governing equations..
Learning Outcomes and Competences	Understanding of the basic characteristics of convective heat transfer. Learning and applications of methods used to the solution of convective heat transfer problems. Interpret the results of solved problems.
Textbook and /or Reference	1. W.M.Kays, M.E. Crawford and B.Weigand, Convective Heat and Mass Transfer, McGraw-Hill Book Company, 4th Ed., 2005. 2. White, F. M. Viscous Fluid Flow. McGraw-Hill Book Company., 3th Ed., 2006.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	20
	Quizzes		
	Homeworks	X	10
	Projects	X	5
	Term Paper	X	5
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Nevzat ONUR

Week	**Subject**
1	Fundamentals of Convection heat transfer.
2	Dimensionless analysis and dinamic similarity.
3	Differential formulations of fundamentals rules.
4	Differential formulations of fundamentals rules.
5	Exact solutions of one dimension flows.
6	Boundary layer theory.
7	Integral Method.
8	Integral Method.
9	Laminar convection heat transfer in channels.
10	Laminar convection heat transfer in channels.
11	Natural convection.
12	Introduction to turbulence.
13	Heat transfer in turbulent flow.
14	Heat transfer in turbulent flow.

MM 567 HEAT TREATMENT								**MECHANICAL ENGINEERING DEPARTMENT**	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	36	6				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Fundamental concepts: Iron-carbon phase diagram, time-temperature-transformation (TTT) diagram, formations of pearlite, bainite and martensite, diffusion. Alloying elements in steel: Austenite, ferrite, carbide, nitride forming elements, effects on eutectoid point, effects on TTT diagrams. Hardenability: Grossmann and Jominy tests, practical applications. General heat treatments: Annealing, normalizing, hardening, tempering, transformation of retained austenite. Special heat treatments: Tool steels, surface hardening methods. Dimensional changes during heat treatment.
Course Objectives	To introduce steel which is the most commonly used industrial alloy, alloying elements for steel, TTT diagram which is very important for phase transformation, hardenability concept and heat treatments for various steels.
Learning Outcomes and Competences	To know the importance of heat treatment for steels and heat treatment techniques. To design, perform and evaluate experiments To apply the knowledge of mathematics, science an engineering
Textbook and /or Reference	1. Thelning, K-E., (1984) Steel and Its Heat Treatment (2nd Ed.), Butterworths, London, UK. 2. Thelning, K-E., (1987) Çelik ve Isıl İşlemi, Çev: Adnan Tekin, Flaş Matbaacılık, İst. 3. Krauss, G., (1990) Steels: Heat Treatment and Processing Principles, Tempering of Steel, ASM Intl. 4. Topbaş, M. Ali, (1992) Çeliğin Isıl İşlemi, Yıldız Teknik Üniversitesi Yayın no:250, İst.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Assist. Prof. Dr. Ibrahim USLAN

Week	**Subject**
1	Fundamantals concepts: Fe-C phase diagram.
2	Fundamentals concepts: Time-Temperature-Transformation (TTT) diagrams.
3	Formation of Pearlite, Bainete and Martensite Diffusion.
4	Alloying elements in Steel: Austenite, ferrite, carbide forming elements
5	Alloying elements in Steel: Nitride forming elements, effects on eutectoid point, effect on TTT diagrams.
6	Hardenability: Grossmann and Jominy Tests.
7	Hardenability: Practical applications.
8	General Heat Treatments:Annealing.
9	General Heat Treatments:Normalizing, hardening.
10	General Heat Treatments: Tempering, transformation of retained austenite.
11	Special Heat Treatments: Teel steels.
12	Special Heat Treatments: Surface hardening methods.
13	Special Heat Treatments: Surface hardening methods.
14	Dimensional changes during heat treatment.

MM 569 COMPUTER INTEGRATED MANUFACTURING					**MECHANICAL ENGINEERING DEPARTMENT**				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	32	10			20	126	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Manufacturing stages of a product by using computer-aided design and manufacturing (CAD/CAM) systems, the scope of computer-integrated manufacturing (CIM), fundamentals of computer-aided design (CAD), group technology, computer aided process (production) planning (CAPP), integrated manufacturing planning and control, manufacturing control (computer control and numerical control), developing a CIM strategy (technology issues, fundamentals of networking, development of a successful strategy).
Course Objectives	To teach computer integrated manufacturing principles and to introduce new approaches applied to manufacturing systems to obtain better performance measures
Learning Outcomes and Competences	To be familiar with the trends in computer integrated manufacturing and basics of machine-computer interfaces
Textbook and /or Reference	M. P. Groover, Automation, production Systems and Computer Integrated Manufacturing, Prentice Hall, 1987, ISBN: 0-13-054610-0 T. C. Chang, R. A. Wysk and H. P. Wang, Computer Aided Manufacturing, Prentice Hall, 1991, ISBN: 0-13-161571-8.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper	X	20
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Prof. Dr. Can ÇOĞUN
Week	**Subject**
1	Manufacturing stages of a product by using computer-aided design and manufacturing (CAD/CAM) systems,
2	The scope of computer-integrated manufacturing (CIM),
3	Fundamentals of computer-aided design (CAD)
4	Group technology
5	Group technology
6	Group technology
7	Computer aided process (production) planning (CAPP)
8	Computer aided process (production) planning (CAPP)
9	Integrated manufacturing planning and control, manufacturing control (computer control and numerical control),
10	Developing a CIM strategy, technology issues,
11	Fundamentals of networking, development of a successful strategy
12	Fundamentals of networking, development of a successful strategy
13	Fundamentals of networking, development of a successful strategy
14	Fundamentals of networking, development of a successful strategy

MM 575 RANDOM VIBRATIONS									**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Mathematical description of stochastic processes. Probability distributions, averages, autocorrelation and cross-correlation, frequency decomposition of stationary random processes, spectral density. The normal and Gaussian random processes. Wideband and narrowband random processes. Transmission of random vibrations. Fourier analysis, Fast Fourier Transforms and its applications in random vibrations. Response of linear time invariant systems to stationary random excitation. Failure due to random vibrations. Examples and application of random vibration analysis.
Course Objectives	Introduction to random vibration theory, probability distributions, Fourier analysis, transmissibility of random vibration.
Learning Outcomes and Competences	Understanding of fundementals in the investigation of random vibration theory.
Textbook and /or Reference	1. Newland, D.E., (1997). An Introduction to Random Vibrations, Spectral & Wavelet Analysis. Singapure: Longman. 2. Bendat, J.S. Ve Piersol, A.G. (1986). Random Data: Analysis and Measurement Procedures. USA: Wiley-Interscience.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60
Instructors	Prof. Dr. Nizami AKTÜRK		

Week	**Subject**
1	Mathematical discription of stochastic processes
2	Mathematical discription of stochastic processes
3	Autocorolation and cross-corelation
4	Normal distribution and spectral density
5	Wide and norrow processes
6	First midterm
7	Transmission of random vibration
8	Fourier analysis
9	FFT and its application to random vibration
10	Response of linear system to stationary random excitation
11	Response of linear system to stationary random excitation
12	Response of linear system to stationary random excitation
13	Second midterm
14	Failure due to random vibrations

MM 576 VIBRATION OF CONTINUOUS SYSTEMS									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Initial and Boundary-value problems in continuous systems. General formulation of the eigenvalue problem. Transverse vibration of strings, longitudinal vibration of rods, bending vibration of bars and torsional vibration of shafts. Vibration of membranes and plates. Analytical methods, approximate methods and finite element method. Special cases.
Course Objectives	Investigation of vibrations of rods, beams, shafts, membranes and plates which are the basic structures of continuous systems .
Learning Outcomes and Competences	Understanding of fundementals in the investigation of continuous system vibrations.
Textbook and /or Reference	1. Meirovitch, L. (1967). Analytical Methods in Vibrations. New York: McMillan. 2. Meirovitch, L. (1986). Elements of Vibration Analysis. Singopure: McGraw Hill. 3. Inman, D.J. (2001). Engineering Vibration. New Jersey: Prentice Hall.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects	X	20
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	Assoc. Prof. Dr. Şefaatdin YÜKSEL

Week	**Subject**
1	Introduction
2	Boundary Value Problems in Continuous Systems. Analytical Methods
3	Transverse Vibration of Strings
4	General Formulation of the Eigenvalue Problem
5	Boundary Conditions, Types of Functions and expansion theorem
6	Longitudinal Vibration of Rods
7	Bending Vibration of Bars
8	Torsional Vibration of Shafts
9	Vibration of Membranes
10	Vibration of Plates
11	Approximate Methods
12	Approximate Methods
13	Finite Element Method
14	Special Cases

MM 577 ADVANCED MACHINERY VIBRATIONS	MECHANICAL ENGINEERING DEPARTMENT

Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Vibrations of linear multi-degree of freedom systems with and without damping. Systems with viscous, hysteretic and Coulomb damping. Determination of equation of motion with Newton Method, Lagrange Method, Energy Method and generalized coordinates. Influence coefficients, potential and kinetic energy expressions in matrix form. Generalized coordinates and generalized forces. Eigenvalue problem and system response. Solution of equation of motion and vibration modes; analytical methods, numerical methods and computational analysis of vibrations and mode shapes Determination of natural frequencies and mode shapes; Dunkerley's Formula, Rayleigh's Method, Holzer's Method, matrix iteration method, Jacobi's Method. Orthogonality of normal modes, expansion theorem. Unrestrained systems. Introduction to rotor dynamics. Predictive maintenance and some case studies form the industry.
Course Objectives	Determination of equations of motion and investigation of vibrations of multi-degree of freedom systems.
Learning Outcomes and Competences	Understanding of fundementals in the investigation of multi-degree of freedom system vibrations.
Textbook and /or Reference	1. Meirovitch, L. (1986). Elements of Vibration Analysis. Singopure: McGraw Hill. 2. Inman, D.J. (2001). Engineering Vibration. New Jersey: Prentice Hall. 3. Meirovitch, L. (1967). Analytical Methods in Vibrations. New York: McMillan.

Assessment Criteria		If any, mark as (X)	Percentage (%)
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof.Dr.Nizami AKTÜRK, Assoc. Prof. Dr. Şefaatdin YÜKSEL

Week	Subject
1	Introduction: Vibrations of Linear Multi-Degree of Freedom Systems with and without Damping
2	Systems with viscous,Hysterestic and Coulomb Damping
3	Determination of Equation of Motion with Newton Method
4	Lagrange Method, Energy Method and Generalized Coordinates
5	Influence Coefficients, Patantial and Kinetic Energy Exoressions in Matrix Form
6	Generalized Coordinates and Generalized Forces
7	Eigenvalue Problem and System Response
8	Solution of Equation of Motion and Vibration Modes;analytical Methods
9	Numerical Methods and Computational Analysis of Vibrations and Mode Shapes
10	Determination of Natural Frequencies and Modes Shapes; Dunkerley's Formula, Rayleigh's Method
11	Holzer's Method, Matrix Iteration Method, Jacobi's Method
12	Orthogonality of Normal Modes, Expansion Theorem
13	Unrestrained Systems. Introduction to Rotor Dynamics
14	Predictive Maintenance and Some Case Studies form the Industry

MM 578 PLATE AND SHELL THEORIES									MECHANICAL ENGINEERING DEPARTMENT
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	42	20		40	20	66	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Classical and First Order Plate Theories. Laminated plate theories. Cylindrical bending plate equations. Boundary conditions. Method of analytical solution techniques. Derivations of the shell equations. Axially symmetric shell structures. Solutions of engineering problems for the plate and shell type structures.
Course Objectives	Gain an experiance about the engineering problems in the consideration of plate and shells in which the theoretical knowledge and solution techniques place a very important place in solid mechanics.
Learning Outcomes and Competences	Gain general overview about the theories and their solution techniques
Textbook and /or Reference	1. Ansel G. Ugural, Stresses in Plates and Shells,McGrawHill I.E.,Second Ed. 2. J.N. Reddy, Mechanics of Laminated Composite Plates Theory and Analysis,CRC Press,1994. 3. S.P.Timeshenko, S.W.Kriger, Theory of Plates and Shells, McGraw-Hill,1959.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks	X	10
	Projects		
	Term Paper	X	20
	Laboratory Work		
	Other		
	Final Exam	X	30

Instructors	Asst. Prof. Dr. Ezgi GÜNAY
Week	**Subject**
1	General overview of concepts : Stress/strain definitions
2	Rectangular plate bending equations
3	Circular plate bending equations and their solutions
4	Rectangular plates and the solutions of their differential equations
5	Plates with different geometrical shapes
6	Plates with different geometrical shapes, selection of the term projects
7	Anisotropic plates, general Hook law
8	Classical and first order laminated plate theories
9	Solution methods about Classical and First Order Laminated Plate Theories
10	Large deformation in plates
11	Stress distributions on symmetric/axisymmetrically loaded shells
12	Bending equations of shells
13	Cylindrical shells under general load types
14	Representations on the final projects

MM 585 REACTIVE FLOWS								MECHANICAL ENGINEERING DEPARTMENT	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1-2	30	12	-	73	73	-	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	None
Course Contents	Fundamental aspects of reactive flow modelling. Construction of mathematical background. Reactive gas dynamics and general conservation equations for multi-component reacting systems. Reactive laminar flows and flames. Reactive laminar fuel jets and their analyses. Single-media and two-medium reactive laminar flow analyses. Reactive turbulent flows and flames. Reactive turbulent fuel jets and their analyses. Single-media and two-medium reactive turbulent flows and turbulence models.
Course Objectives	Derivation and analysis of reactive flow conservation equations in a single-madia and-two medium. Analysis of flame and fuel jets
Learning Outcomes and Competences	Construction of reactive flow model. Analysis of reactive flow parameters and their effects on the flow.
Textbook and /or Reference	1. K. Kuo, Principles of Combustion, John Wiley & Sons, 2nd Ed. 1986, 810pp. 2. B. Spalding, Combustion and Mass Transfer, Pergamon press, 1st Ed. 1979, 409 pp. 3. R. B. Bird, W.E. Steward and E.N. Lightfoot, Transport Phenomena, Wiley, 2nd Ed., 2001. 4. M. Kaviany, Principles of Convective Heat Transfer, Springer-Verlag, 1994, 675 pp. 5. E.R.G. Eckert, R.M. Drake, Analysis of Heat and Mass Transfer, Hemisphere Publ., 1987, 6. N. Peters, Turbulent Combustion, Cambridge University Press, 2000, 1st Ed., 264 pp. 7. A. Murty Kanury, Introduction to Combustion Phenomena, Gordon and Breach Science Publishers, 1st Ed., 1975, 406 Pages. 8. R.A. Strehlow, Combustion Fundamentals, McGraw-Hill, 1984, 538 Pages. 9. G.E. Mase, Theory and Problems of Continuum Mechanics, Schaum's outline series, McGraw-Hill, 1970, 216pp

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks	X	20
	Projects		
	Term Paper	X	10
	Laboratory Work		
	Other		
	Final Exam	X	30

Instructors	Asst. Prof. Dr. Atilla BIYIKOĞLU
Week	**Subject**
1	Mathematical background and index notation
2	Mathematical background and index notation
3	Conservation equations for multi-species reactive systems
4	Conservation equations for multi-species reactive systems
5	Reactive gas dynamics
6	Reactive gas dynamics
7	Laminar reactive flows in a single media
8	Laminar reactive flows in a single media
9	Laminar reactive flows in two medium
10	Laminar reactive flows in two medium
11	Turbulent reactive flows in a single media
12	Turbulent reactive flows in a single media
13	Turbulent reactive flows in two-medium
14	Turbulent reactive flows in two-medium

MM 591 ANALYTICAL METHODS IN MECHANICAL ENGINEERING					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Non linear ordinary differential equations. Quasi linearization, Picards iteration, perturbation methods. Fourier series. Special fourotians (Bessel, Legendre, error etc.) Boundary value problems and Sturm Liouville problems. Partial differential equations. Variational calculus. Complex variables theory. Residues and definite integrals. Integral transform techniques (Laplace and Fourier transforms, Convolution theorem, Finite Fourier transforms etc. Fourier integrals) and its applications to partial differential equations. Green's functions and its applications
Course Objectives	Analitical methods of mathematical analysis are provided as basic tools for the understanding and formulation of general prinsiples and solution of IBVP's.
Learning Outcomes and Competences	Students gain the ability to approach the scientific & engineering problems by means of proper tools of general and applied mathematics.
Textbook and /or Reference	1. O'Neil, P.V., (2003). Advanced Engineering Mathematics, 5th ed.. Brooks/Cole. 2. Greenberg, M.D., (1978). Foundation of Applied Mathematics. Prentice Hall. 3. Glyn James and Others. Busley, Clemsib, Dyke, (1993). Advanced Modern Engineering Mathematics, 2nd ed.. Addison-Wesly.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM
Week	**Subject**
1	Fourier Series
2	Fourier Series
3	Special Functions
4	Special Functions
5	Method of Seperation Variable
6	Method of Seperation Variable
7	Midterm Exam 1
8	Complex Numbers
9	Complex Functions, Complex Integration
10	Series Representations of Functions
11	Residue Theorem
12	Residue Theorem
13	The Laplace Transform
14	Midterm Exam 2

MM 594 VARIATIONAL METHODS IN ENGINEERING										**MECHANICAL ENGINEERING DEPARTMENT**
Semester	**Methods of Education**							**Credits**		
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**	
1,2	12	30				146	188	3	7.5	

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	The concept of a functional. Variation as linear part of the increment of a functional. Necessary and sufficient conditions for the extrema of a functional. Variational principles corresponding to differential boundary-value problems. Canonical equations. Canonical transformations. Noether's theorem. Hamilton's principle for dissipative systems. Ritz method for multi-variable functions. Application to numerical analysis and finite element analysis.
Course Objectives	Mechanics of deformable bodies involves the study of stress, strain, and temperature distribution in a solid or fluent body subjected to mechanical and termal loading.
Learning Outcomes and Competences	Students are provided by the knowledge of formulation and analysis of the basic boundary/initial-value problems at the proper level of mathematical methods that enable them to understand the general underlying principles.
Textbook and /or Reference	Lanczos, C., (1974). The Variational Prinsible of Mechanics. University of Tesonda Press. Reddy, J.N., (1986). Applied Functional Analysis and Variational Methods in Engineering. McGraw-Hill.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	30
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	70

Instructors	Prof. Dr. Ali Unal ERDEM

Week	**Subject**
1	The Concept Of Functional
2	Variation as Linear Part of The İncrement of a Functional
3	Variation as Linear Part of The İncrement of a Functional
4	Necessary and Suffiient Condition for the Extrama of a Function
5	Variational Principles Corresponding to Differantial Boundary Value Problems
6	Variational Principles Corresponding to Differantial Boundary Value Problems
7	Canonical Equations
8	Canonical Transformations
9	Noether's Theorem
10	Hamilton's Principle for Dissipative System
11	Hamilton's Principle for Dissipative System
12	Ritz Method for Multi-Variable Functions
13	Application to Numerical analysis and Finite Element Analysis
14	Application to Numerical analysis and Finite Element Analysis

MM 595 APPLIED COMPUTATIONAL FLUID DYNAMICS					MECHANICAL ENGINEERING DEPARTMENT				
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1-2	18	24	60	50		36	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	Non
Course Contents	General conservation laws and boundary conditions. Application of the finite volume method to the equations of fluid mechanics and heat transfer. Diffusion, convection, transient and source terms of the equations. Numerical approaches, algebraic equations, computational cell structure. Application of boundary conditions. Introduction to turbulent flow, transition from laminar to turbulent flow, turbulent Navier-Stokes equations, characteristics of turbulent flow, turbulence models and their equations, k-ε turbulence model, boundary conditions. Principles of Computational Fluid Dynamics (CFD), the PHOENICS CFD code, how does PHOENICS work, programs forming PHOENICS, boundary conditions, source terms. Solution of various engineering problems using PHOENICS: two and three dimensional heat conduction, forced convection inside a channel, variable cross section and blocked channel flow, natural and mixed convection problems, transient flow and heat transfer, impinging fluid jets, problems on cooling of electronic components, and similar two/three dimensional, laminar/turbulent, steady/transient, flow and heat transfer problems in cartesian/polar coordinates.
Course Objectives	To teach theoretical knowledge and practical application ability for realization of solutions for various heat transfer and fluid flow problems encountered in engineering with a computational fluid dynamics code.
Learning Outcomes and Competences	For a large number of heat transfer and fluid flow situations, a successful student in accord with the objective will be able to: theoretically define, choose the solution methods, solve with the PHOENICS code and interpret the solution of the problem.
Textbook and /or Reference	1.Versteeg, H. K. and Malalasekera, W., "An Introduction to Computational Fluid Dynamics", Longman, 1995. 2.Patankar, S. V., "Numerical Heat Transfer and Fluid Flow", McGraw-Hill, 1980. 3.Shaw, C. T., "Using Computational Fluid Dynamics", Prentice Hall, 1992. 4.Roache, P. J., "Fundamentals of Computational Fluid Dynamics", Hermosa, 1998. 5.Wendt, J. F., "Computational Fluid Dynamics, An Introduction", Springer, 1996. 6.Hoffmann, K. A., "Computational Fluid Dynamics For Engineers", EES, 1989.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	20
	Quizzes	-	-
	Homeworks	X	10
	Projects	X	10
	Term Paper	X	10
	Laboratory Work	X	10
	Other	-	-
	Final Exam	X	40

Instructors	Prof. Dr. Şenol BAŞKAYA

Week	**Subject**
1	General conservation laws and boundary conditions.
2	Application of the finite volume method to the equations of fluid mechanics and heat transfer.
3	Numerical approaches, algebraic equations, computational cell structure, application of boundary conditions.
4	Introduction to turbulent flow, turbulent Navier-Stokes equations, characteristics of turbulent flow.
5	Turbulence models and their equations, k-ε turbulence model, boundary conditions.
6	Principles of Computational Fluid Dynamics (CFD), the PHOENICS CFD code.
7	Programs forming PHOENICS, boundary conditions, source terms.
8	Solution of various engineering problems using PHOENICS.
9	Two and three dimensional heat conduction, forced convection inside a channel.
10	Variable cross section and blocked channel flow.
11	Natural and mixed convection problems.
12	Transient flow and heat transfer.
13	Impinging fluid jets.
14	Problems on cooling of electronic components. Other engineering problems.

MM 596 CONDUCTION HEAT TRANSFER								MECHANICAL ENGINEERING DEPARTMENT	
Semester	**Methods of Education**							**Credits**	
	Lecture	**Recit.**	**Lab.**	**Project/Field Study**	**Homework**	**Other**	**Total**	**Credit**	**ECTS credit**
1,2	12	30				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Continuum concept. Integral and differential formulation methods. Separation of variables. Orthogonal functions. Solutions in cartesian, cylindrical and spherical coordinate systems. Transient conduction. Duhammel's superposition integral. Solutions with Laplace transform and Fourier integrals. Normalization.
Course Objectives	To train students to formulate and solve engineering and scientific problems involving conduction heat transfer and to prepare students for individual research.
Learning Outcomes and Competences	Gaining the ability in the derivation and usage of heat conduction equation. Learning the methods of separation of variables, integral and Laplace transforms and numerical techniques, integral and variational methods to solve heat conduction problems in rectangular, cylindrical and spherical coordinates.
Textbook and /or Reference	1. Kakaç, S. and Yener,Y., (1993), Heat Conduction, Philadelphia, Pa:Taylor and Francis, 2. Arpaci, V.S., (1966), Conduction Heat Transfer, Addison-Wesley.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	50
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	50

Instructors	Prof. Dr. Mecit SİVRİOĞLU

Week	**Subject**
1	Introduction
2	General Heat Conduction Equation
3	One- Dimensional Steady- State Heat Conduction
4	One- Dimensional Steady- State Heat Conduction
5	Ortogonal Functions, Fourier Expansions and Finite Fourier Transforms
6	Steady two and three Dimensional Heat Conduction: Solutions with Seperation of Variables
7	Steady two and three Dimensional Heat Conduction: Solutions with Seperation of Variables
8	Midterm Exam 1
9	Unsteady Heat Conduction: Solutions with Seperation of Variables
10	Solutions with Integral Transforms
11	Solutions with Laplace Transforms
12	Midterm Exam 2
13	Further Methods of Solutions
14	

MM 597 ADVANCED NUMERICAL METHODS FOR ENGINEERS	MECHANICAL ENGINEERING DEPARTMENT

Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	18	24				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Solution of non linear equations, Newton Raphson method, improved Newton-Raphson method, secant method. Numerical solution of non linear boundary value problems of ordinary differential equations. Numerical solution of linear and nonlinear partial differential equations; parabolic equations, hyperbolic equations, elliptic equations. Iteration methods. Nonlinear boundary conditions. Two and three dimensional elliptic and parabolic partial differential equations.
Course Objectives	To teach the numerical methods used in the solution of ordinary and partial differential equations which are encountered in engineering problems and to improve the computer skills of the students.
Learning Outcomes and Competences	After completion of the course, students are expected to be able to apply basic numerical methods to the solution of ordinary and partial differential equations with appropriate boundary and initial conditions; develop algorithms and programs in a computer language and interpret the numerical results.
Textbook and /or Reference	1. Rao, S. S. (2002). Applied Numerical Methods for Engineers and Scientists. Prentice Hall. 2. Smith, G.D. Numerical Solution of Partial Differential Equations. Clarendon Press – Oxford. 3. Chapra, S. C. And Canale R. P. (1998). Numerical Methods for Engineers. Third Edition. McGraw-Hill Inc.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Nuri YÜCEL

Week	Subject
1	Fundamentals of Numerical Methods: Solution of non-linear equations; solution methods for systems of linear algebraic equations.
2	Fundamentals of Numerical Methods: Numeric integration (rectangular; trapezoidal; Simpson's; Gauss-quadratures) methods
3	Fundamentals of Numerical Methods: Interpolation, curve fitting, numeric differentiation.
4	Ordinary Differential Equations: First order initial value problems (Euler's method, three-term Taylor series method; Runge-Kutta method).
5	Ordinary Differential Equations: Second and higher order initial value problems (Taylor series method; Runge-Kutta method; Runge-Kutta-Nystrom method).
6	Ordinary Differential Equations: Boundary value problems; mixed boundary conditions; shooting method.
7	Midterm exam I
8	Numerical Solutions of Parabolic Equations: Explicit method; implicit methods.
9	Numerical Solutions of Parabolic Equations: Mixed boundary conditions; convergence and stability.
10	Numerical Solutions of Hyperbolic Equations: Explicit method; Courant-Lewy-Friedrichs condition.
11	Numerical Solutions of Hyperbolic Equations: Method of characteristics
12	Midterm exam II
13	Numerical Solutions of Elliptic Equations: Control volume formulation; boundary conditions.
14	Numerical Solutions of Parabolic Equations: Formulation for curved boundaries; Gauss-Seidel iteration method.

MM 601 ADVANCED FLUID MECHANICS									MECHANICAL ENGINEERING DEPARTMENT
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	30	12				146	188	3	7.5

Language	Turkish
Compulsory / Elective	Optional
Prerequisites	-
Course Contents	Introduction to fluid mechanics. Scalar, vector and tensor analysis. Definition of continuum. Lagrangian and Eulerian description of fluid motion. Transport theorem. Kinematics of fluid motion; streamline, streak line, pathline, vorticity circulation and deformation. Fundamental equations and constitutive relations; continuity, momentum and energy equations. Subsonic potential flow. Application of complex functions to two-dimensional potential flows. Conformal mapping. Surface waves.
Course Objectives	To describe the basic approaches used for flow analysis. To derive basic equations governing fluid flows. To teach and apply basic analytical methods employed for solution of these equations. To solve engineering problems analytically by simplifying governing equations.
Learning Outcomes and Competences	Understanding of the basic characteristics of fluid motion. Learning and applications of methods used to solve flow problems. Interpret the results of solution of flow problems.
Textbook and /or Reference	1. Currie, I. G. Fundamental Mechanics of Fluids. McGraw-Hill Book Company. 2. White, F. M. Viscous Fluid Flow. McGraw-Hill Book Company. 3. Schlichting, H. Boundary Layer Theory. McGraw-Hill Book Company.

Assessment Criteria		**If any, mark as (X)**	**Percentage (%)**
	Midterm Exams	X	40
	Quizzes		
	Homeworks		
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	60

Instructors	Prof. Dr. Haşmet TÜRKOĞLU
Week	**Subject**
1	Introduction: Definitions,Continuum Approach, vector and Tensor Analysis
2	Basic Laws:Conservation of Mass, Newton's Second Law, The First Law of Thermodynamics
3	Viscous Flows: Constitutive Relations, Governing Equations, Boundary Conditions
4	Analysis of Viscous Flows: Solution of Viscous Flows
5	Analysis of Viscous Flows: Solution of Viscous Flows
6	Kinematics of Flow: Streamline, Pathline, Streakline and Timeline, Vortex, Circulation, Fluid Rotation and Deformation
7	Inviscid Flow: Complex Functions, Complex Potential, Complex Velocity
8	Midterm Exam 1
9	Inviscid Flow: Elemantary Plane Flows, Uniform Flow, Source Flow, Sink Flow, Vortex Flow and Doublet
10	Inviscid Flow: Superposition of Elemantary Plane Flows
11	Inviscid Flow: Conformal Trnasformation, Joukowski Transformation, Schwarz-Christofell Transformation
12	Inviscid Flow: Analysis of Flow over Ellipse and Airfoils
13	Mıdterm Exam 2
14	Surface Waves: Governing Equations of Surface Waves, Diffusion of Surface Waves, Standing and Moving Surface Waves