MASTER OF SCIENCE INPHYSICS

The students should fulfill the curriculum of 7 courses, seminar and thesis at most 3 years.

Documents for Application

Required documents are listed below:

Application Documents	M.Sc.	Ph.D.	Ph.D. on B.Sc.
Application Form			
Diploma (Equivalency Certificate for Students Studied Abroad)	Bachelor's Degree Diploma	Bachelor's and M.Sc. Degree Diplomas	Bachelor's Degree Diploma
Transcript			CGPA: 3.00
ALES (is required for Turkish) GRE (is recommended for foreigner)	ALES: 55 GRE: 149	ALES: 55 GRE: 149	ALES: 80 GRE: 156
English Proficiency*	TOEFL IBT:66 YDS:55	TOEFL IBT:66 YDS:55	TOEFL IBT:66 YDS:55
Two Reference Letters			
Four Photo			

Documents for Registration

Students who pass the oral exam can register the program.

M.Sc. and Ph.D. on B.Sc.	Ph.D.
Original and photocopy of Bachelor's degree diploma	Original and photocopy of M.Sc. diploma
Original and photocopy of transcript for Bachelor's degree	Original and photocopy of diploma for M.Sc.

Copy of ALES (is mandatory for Turkish applicants) or GRE result (is recommended for foreign applicants)
English proficiency document (YDS,TOEFL)
Certificate of military service for male applicants
Original and photocopy of national ID card
Proof of residency
4 photos

	MASTER OF SCIENCE IN PHYSICS					
	First term	**ECTS**				**Cr**
PHYS 511	**ELECTROMAGNETISM I** Static electric and magnetic fields, boundary value problems, time-dependent fields, Maxwell's equations, multipole expansion, interaction of radiation with matter, interference and diffraction, waveguides and cavities, electromagnetism and relativity.	10	4	0	0	4
PHYS 541	**STATISTICAL PHYSICS & THERMODYNAMICS** Probability, random walk. Binomial, Gaussian and Poisson distributions. Mean value and standard deviation. Statistical ensemble. Thermodynamic laws**.** Entropy, Enthalpy. Carnot cycle. Schottky defect. Helmholtz free energy. Paramagnetism**.** Curie's law. Negative temperature. Perfect classical gas**.** Partition function. Maxwell velocity distribution. Quantum statistics. Fermi-Dirac, Bose-Einstein, Maxwell-Boltzmann distributions. Blackbody radiation. Planck's law. Thermodynamic functions.	10	4	0	0	4
PHYS 561	**MATHEMATICAL METHODS AND CLASSICAL MECHANICS** Scalars, vectors and tensors, generalized coordinates, Linear algebra review. Lagrange's Equations. Divergence, curl, Gauss's and Stokes's theorems. Particles and systems of particles. Symmetries and conservation laws Hamilton's principle and Lagrange's equations. Constrained systems. Small oscillations. Two body central force problem. Classical scattering theory. Rotating coordinate systems. Centrifugal and Coriolis forces. Solvable problems in rigid body mechanics. Legendre transformations. Hamilton's canonical equations. Canonical Transformations. Poisson Brackets. Hamilton Jacobi Theory. Action Angle Variables.	10	3	1	0	3
		30	11	0	0	**11**
	Second term					
PHYS 521	**QUANTUM MECHANICS I** Foundations of wave mechanics, Schrödinger's equation, eigenvalues and eigenvectors, angular momentum, matrices in quantum mechanics, symmetry, approximation methods, scattering.	10	4	0	0	4
PHYS 514	**RESEARCH METHODS** Scientific statements, formulating a research problem, collecting data, measurement, signal processing, the scientific method, mathematical models, research design, uncertainty, probability and statistics in	10	3	0	0	3

	research, probability theories, Bayes' theorem, ethics and responsibility in scientific research, writing a research proposal					
PHYS 542	**ADVANCED METROLOGY** Uncertainty in measurements and its calculation with respect to GUM, Infrastructure of national /International measurements. Primary and secondary level standards and their conservation, Realization and maintenance of dimensional, electrical and physical quantities used as a primary standards. Constructing some primary level standards and recent developments in the area.	10	2	0	2	3
	ELECTIVE	10	3	0	0	3
		40	12	0	2	**13**
	Third term					
PHYS 590	**RESEARCH SEMINAR**	**2**				NC
	Fourth term					
PHYS 600	**MSc THESIS**	**60**				
	TOTAL:	**132**				**24**

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ELECTROMAGNETISM I	PHYS 511	1	4+ 0+0	4	10

Prerequisites	-

Language of Instruction	English
Course Level	Postgraduate
Course Type	Compulsory
Course Coordinator	
Instructors	Assoc.Prof.Dr.Ertan Akşahin
Assistants	
Goals	To give the ability of making researches in the field of electromagnetizm
Content	Electromagnetic waves and physical optics

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1)To know about Maxwell's Equations	1,2,3	A,C
2)To have enough knowlage to discuss the Properties of Eloctromagnetic waves	1,2,3	A,C
3)To learn matematical forms of wave guides	1,2,3	A,C
4) To have an idea about Relativistic electrodynamics	1,2,3	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study
Assessment Methods:	A: Testing, C: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Electrostatic and electromagnetic fields	

2	Boundry value problems	
3	Time varient fields	
4	Maxwell’s Equations	
5	Multipole Expantions	
6	Midterm Exam	
7	Interaction of light with matter	
8	Interferance	
9	Difractions	
10	Waveguıdes and cavities	
11	Lorentz Transformations	
12	Midterm Exam	
13	Relativity and electromagnetism	
14	General Revision	

RECOMMENDED SOURCES	
Textbook	Tai L. Chow Electromagnetic Thory
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	30
Assignment	2	30
Assignment	1	40
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL		40

GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms	2	10	20
Assignment	10	6	60
Final examination	1	10	10
Total Work Load			242

Total Work Load / 25 (h)			9,68
ECTS Credit of the Course			10

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
STATISTICAL PHYSICS & THERMODYNAMICS	PHYS541	1	3 + 0+0	3	10

Prerequisites	

Language of Instruction	English
Course Level	Postgraduate
Course Type	Compulsory
Course Coordinator	Prof. Necdet Aslan
Instructors	
Assistants	
Goals	
Content	

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Fundamentals of statistics	1,2	A,B,C
2) Fundamentals of thermodynamics	1,2	A,B,C
3) Quantum statistics	1,2	A,B,C
4) Kinetic theory of gases	1,2	A,B,C
5) Magnetism and properties	1,2	A,B,C
6) Thermodynamics cycles	1,2	A,B,C

Teaching Methods:	1: Lecture, 2: Question-Answer
Assessment Methods:	A: Testing, B:Course project, C: Homework

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	INTRODUCTION	
2	DISTRIBUTION FUNCTIONS	Distributions
3	INTERACTION AMONGST MACROSCOPIC SYSTEMS	Partition function
4	THERMODYNAMICS LAWS	0. law
5	APPLICATIONS OF THERMODYNAMICS	1. & 2. law
6	STATISTICAL THERMODYNAMICS	
7	APPLICATIONS OF STATISTICAL THERMODYNAMICS	
8	ADVANCED QUANTUM STATISTICS	Microscopic systems
9	ADVANCED MAGNETISM APPLICATIONS	
10	FERRO-PARA-DIA MAGNETISM DEFINITIONS	magnetism
11	ADVANCED GASES KINETIC THEORY	gases
12	FUNDAMENTALS OF PLASMA PHYSICS	plasma
13	THERMODYNAMICS CYCLES	
14	THERMODYNAMICS CYCLES APPLICATIONS AND TECHNOLOGY	

RECOMMENDED SOURCES	
Textbook	**Introduction to Plasma Physics and Controlled Fusion**
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	10 homeworks
Exams	1 midterm, 1 final

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	30
Homework	2	20
Final	1	50

Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	3	48
Hours for off-the-classroom study (Pre-study, practice)	14	12	168
Mid-terms	1	3	3
Assignment	2	12	24

Final examination	1	3	3
Total Work Load			246
Total Work Load / 25 (h)			9.84
ECTS Credit of the Course			10

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATHEMATICAL METHODS AND CLASSICAL MECHANICS	PHYS 561	1	3 + 1	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Graduate
Course Type	Compulsory (Theory Option)
Course Coordinator	Prof. Dr. Avadis Hacinliyan
Instructors	Prof. Dr. Avadis Hacinliyan
Assistants	
Goals	Introducing mathematical methods of physics such as vector and tensor analysis, linear algebra, Laplace and Poisson Equations. Introducing the physical and mathematical basis of classical mechanics, analytical mechanics, symmetry and invariance principles. Studying Lagrangian and Hamiltonian formulations, canonical transformations, Poisson brackets, Hamilton Jacobi theory, perturbation theory. Investigating problems that can be exactly or approximately solved.
Content	Scalars, vectors and tensors, generalized coordinates, Linear algebra review. Lagrange’s Equations. Divergence, curl, Gauss's and Stokes's theorems. Particles and systems of particles. Symmetries and conservation laws Hamilton’s principle and Lagrange’s equations. Constrained systems. Small oscillations. Two body central force problem. Classical scattering theory. Rotating coordinate systems. Centrifugal and Coriolis forces. Solvable problems in rigid body mechanics. Legendre transformations. Hamilton’s canonical equations. Canonical Transformations. Poisson Brackets. Hamilton Jacobi Theory. Action Angle Variables.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Create the physical and mathematical background that the student will need in the graduate level.	1,2,3	A,B,C
2) Lay the mathematical and mechanical foundation for problems that the student will encounter in graduate studies.	1,2,3	A,B,C
3) Skill to apply knowledge in physics and mathematics Motivation And Behavior	1,2,3	A,B

4) Teach basic mathematical methods and variational principles and the Lagrange, Hamilton, Hamilton Jacobi and Poisson formulations.	1,2,3	A,B
5) Exact and approximate computation methods	1,2,3	A,B,C
6) Skill to define, formulate and solve physical problems.	1,2,3	A,B,C
7) Skill to use the techniques and means necessary for physics applications.	1,2,3	A,B,C

Teaching Methods:	1: Lecture, 2: Problem Sets, 3: Presentations
Assessment Methods:	A: Examination, B: Homework C: Presentation

COURSE CONTENT

Week	Topics	Study Materials
1	Vector and scalar fields	Math Methods.
2	Orthogonal and generalized coordinate systems. Lagrange equations.	Math. Meth. İn Physics
3	Permutation symbols. Tensors. Flux, divergence and Gauss' theorem.	Math Meth. in Phys.
4	Curl and Stokes' Theorem. Classical gravitational theory.	Math. Meth. in Phys..
5	Laplace and Poisson Equations. Potential Theory.	Electromagnetic Theory.
6	Systems of particles, Principles of mechanics and conservation laws.	Classical Mechanics
7	Midterm Exam	
8	Hamilton's principle, Calculus of variations and Lagrange's Equations. Symmetry and conservation principles. First Integrals.	Classical Mechanics.
9	Eigenvalues and Eigenvectors. Small oscillations. Normal frequencies and coordinates	Linear algebra. Math. Methods
10	Two body central force problem. Classical scattering theory.	
11	Orthogonal transformations, Rotating coordinate systems. Centrifugal and Coriolis forces.	Classical Mechanics.
12	Solvable problems in rigid body mechanics. Top problem.	Classical Mechanics.
13	Legendre Transformations, Hamilton's canonical equations, Canonical transformations	Math. Meth. Phys.
14	Poisson Brackets, Hamilton Jacobi Theory	Classical Mechanics
15	General Revision and Midterm Exam	

RECOMMENDED SOURCES	
Textbook	H. Goldstein, C. P. Poole Jr., J. L. Safko, Classical Mechanics (3. Baskı), Addison Wesley ve Pearson Education (2002). ; Hans J. Weber, Frank Harris, George B. Arfken] Essential Mathematical Methods for Physicists, Academic Press. G. Stephenson and P. M. Radmore "Advanced Mathematical Methods for Engineering and Science Students, Cambridge University Press
Additional Resources	C. Lanczos, The Variational Principles of Mechanics (2. Edition) Dover (1970) F. Scheck: Mechanics from Newton's Laws to Deterministic Chaos 5. Edition, Springer (2010)

MATERIAL SHARING	
Documents	Ahmed Yüksel Özemre, "(Math. Meth. Phys.) Fizikte Matematiksel Metotlar" and "(Classical Theoretical Mechanics) Klasik Teorik Mekanik" İstanbul University Publication (1998)
Assignments	From Textbook
Exams	

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	80
Quizzes	4	10
Assignment	8	10
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	16	4	64
Hours for off-the-classroom study (Pre-study, practice)	16	5	80
Mid-terms	2	10	20
Quizzes	4	1	4
Homework	8	3	24
Problem Hour and Presentation (Preparation included)	5	8	40
Final examination (Reparation Exam included)	2	10	20
Total Work Load			252
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
QUANTUM MECHANICS I	PHYS 521	1	4 + 0	4	10

Prerequisites	-

Language of Instruction	English
Course Level	Graduate
Course Type	Compulsory (Theory Option)
Course Coordinator	Prof. Dr. Avadis Hacinliyan
Instructors	Prof. Dr. Avadis Hacinliyan
Assistants	
Goals	The aim of this course is to teach the physical principles and interpretation of quantum mechanics and the mathematical principles on which they rest. Calculational techniques will also be emphasized.
Content	Principles of wave mechanics, Schroedinger equation, Eigenvalues and eigenstates, angular momentum, matrices in quantum mechanics, Symmetry, Approximation methods, Scattering.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Introduces the mathematical foundations of quantum mechanics (Differential equations, Vectors and Matrices, Fourier Analysis)	1,2,3	A,B,C
2) Explain the physical principles of quantum mechanics (Classical Mechanics, Correspondance and Uncertainity principles). Introduces scientific and technological applications.	1,2,3	A,B,C
3) Develops skills to apply knowledge of physics and mathematics.	1,2,3	A,B
4) Design and perform experiments(measurement, research setup etc.), develop ability to analyze and interpret experimental results.	1,2,3	A,B
5) Introduces exact and approximate calculation methods.	1,2,3	A,B
6) Develop skill to define formulate and solve physics problems.	1,2,3	A,B
7) Develop skill to apply techniques and devices necessary for physical applications	1,2,3	A,B,C

Teaching Methods:	1: Lecture, 2: Problkem Sets 3: Problem Session
Assessment Methods:	A: Examination B: Homework C: Presentation

COURSE CONTENT		
Week	Topics	**Study Materials**
1	MATHEMATICAL AND PHYSICAL FOUNDATIONS OF QUANTUM MECHANICS	Modern Physics, Math Methods of Physics
2	SCHRÖDINGER WAVE EQUATION, WAVE FUNCTION	Modern Physics,
3	EIGENVALUE AND EIGENVECTORS, EXPANSION POSTULATE, INTERPRETATION AND APPLICATIONS. STRUCTURE OF QUANTUM MECHANICS	Math Methods of Physics Sturm Liouville Theory
4	BOUND AND SCATTERING STATE PROBLEMS IN ONE DIMENSION	Differential Equations, Probability
5	OPERATORS, SYMMETRY AND CONSERVATION LAWS	Classical Mechanics
6	PROBLEMS IN MORE THAN ONE DIMENSION, SEPARATION OF VARIABLES, MANY PARTICLE WAVE FUNCTIONS	Math. Methods in Physics
7	MIDTERM EXAM	
8	MATRIX MECHANICS, ANGULAR MOMENTUM PROBLEM	Linear Algebra
9	PROBLEMS WITH SPHERICAL SYMMETRY. THE HYDROGEN ATOM	Math. Methods in Physics
10	SPİN AND IDENTICAL PARTICLES	Angular Momentum Operators
11	PERTURBATION THEORY	Math. Methods in Physics
12	VARIATIONAL AND OTHER APPROXIMATION METHODS. TIME DEPENDENT PERTURBATION THEORY.	Math. Meth in Physics
13	SCATTERING THEORY	Math. Meth in Physics
14	REVIEW AND MIDTERM EXAMINATION	

RECOMMENDED SOURCES	
Textbook	E.Merzbacher Quantum Mechanics (3. Edition). Wiley,1998

Additional Resources	R: Shankar Principles of Quantum Mechanics, (2. Edition) Springer (1994) L.D.Landau and E. M. Liftshitz Quantum Mechanics. Non-relativistic theory (3. Edition) Butterworth Heinemann (1981)

MATERIAL SHARING	
Documents	"Quantum Mechanics Demystified" David McMahan, Schaum's Outline of Theory and Problems of Quantum Mechanics" by Y. Peleg, R. Pnini, E. Zaarur
Assignments	From the textbook
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	80
Quizzes	4	10
Assignment	8	10
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			

6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

COURSE CATEGORY	Expertise/Field Courses

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	16	4	64
Hours for off-the-classroom study (Pre-study, practice)	16	5	80
Mid-terms	2	10	20
Quizzes	4	1	4
Ödev	8	3	24
Final examination (with reparatioın)	2	10	20
Total Work Load			252
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ADVANCED METROLOGY	PHYS 542	2	3+ 0+0	3	10

Prerequisites	

Language of Instruction	English
Course Level	Postgraduate
Course Type	Compulsory
Course Coordinator	
Instructors	Prof. Dr. Ahmet T. İnce,
Assistant	Res. Assist. Melda Patan Alper
Goals	To provide students with knowledge of how to use physics knowledge in measurements of science.
Content	Brief history of measurements, measurements instruments; instrument classificatic and characteristic, active/passive filter, sensitivity, bias, tolerance etc., Error i measurements, firs and second order instruments, guidelines for evaluating an expressing uncertainty, Primary, secondary and working standards, traceabilit measurements of electrical quantities; Bridge circuits, Null type-Wheatstone bridg deflection bridge etc. temperature measurements; ITS-90 scale, practic temperature measurements etc.

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) To learn measurement systems from past to present	1,2,3	A,C
2) To learn how to use physics knowledge for physical measurements system	1,2,3	A,C
3) To learn the importance of instrument classification and characteristics	1,2,3	A,C
4) To understand wide range of measurement techniques in physics, used for industry.	1,2,3	A,C
5) To understand the realisation and maintanance of SI base units	1,2,3	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study
Assessment Methods:	A: Testing, C: Homework, I:Laboratory

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	History of measurements	
2	Instrument classification and characteristics	
3	Instrument classification and characteristics	
4	Error in measurements system and quide to evaluation of measurement uncertainties	
5	Error in measurements systems and quide to evaluation of measurement uncertainties	
6	Primary, Secondary and working metrological standards	
7	Primary, Secondary and working metrological standards	
8	Measurements of electrical quantatities	
9	Bridge circuits, errors in bridge measurement system	
10	Realisation of national voltage standards, volts	
11	Realisation of national Ampere standard	
12	Realisation of national resistance; quantum hall effect	
13	Temperature measurements; ITS-90 scale	
14	Practical temperature measurements	

RECOMMENDED SOURCES	
Textbook	1. G.M.S. de Silva, "Basic Metrology for ISO 9000 Certification 2. Alan S. Morris, "Principles of Measurements and Instrumentation"
Additional Resources	1. Bernhard Kramer, "The Art of Measurement", PTB, Germany. 2. Tom Duncan, "Success in Electronics"

MATERIAL SHARING	
Documents	Lecturer Notes
Assignments	Homework assignments every three to four weeks
Exams	Two mid-term exams and one final

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	2	40
Home-works and presentations	4	10
Total		
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,		X			
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,			X		
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,					X
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,				X	
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	3	42

Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Mid-terms	2	3	6
Home works and presentations	4	12	28
Final examination	1	3	3
Total Work Load			239
Total Work Load / 25 (h)			9.56
ECTS Credit of the Course			10

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MSc Thesis	PHYS 560	3 & 4			60

Prerequisites	-

Language of Instruction	English
Course Level	MSc
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to work/study on a project about the fields of physics that the student has learned during the eduation.
Content	Finalizing the the project, report writing and presentation

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
Has the ability to work on a project in physics in experimental or theoretical way.	1, 2, 3, 11, 16	D, E, G, H

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 11: Seminar, 16: Oral Exam
Assessment Methods:	D: Proje, E: Report, G:Presentation, H:Application

RECOMMENDED SOURCES	
Textbook	depends on the project
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	

Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Report	1	85
Presentation	2	15
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		15
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		85
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,					X
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,					X
5	Uses the academic sources, the computer technology and the related devices,					X
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,					X
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.					X

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	40	560
Hours for off-the-classroom study (Pre-study, practice)	14	30	420
Report	1	500	500
Presentation	1	10	10
Total Work Load			1490
Total Work Load / 25 (h)			59.6
ECTS Credit of the Course			60

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Research Seminar	PHYS 590	2			2

Prerequisites	-

Language of Instruction	English
Course Level	MSc
Course Type	Compulsory
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to work/study on a project about the fields of physics that the student has learned during the eduation.
Content	Report writing and presentation

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
Has the ability to work on a topic in physics in experimental or theoretical way.	1, 2, 3, 11, 16	D, E, G, H

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 11: Seminar, 16: Oral Exam
Assessment Methods:	D: Project, E: Report, G:Presentation, H:Application

RECOMMENDED SOURCES	
Textbook	depends on the title of the subject
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	

Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Report	1	55
Presentation	2	45
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		45
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		55
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,					X
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,					X
5	Uses the academic sources, the computer technology and the related devices,					X
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,					X
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.					X

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	2	28
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Report	1	3	3
Presentation	1	1	1
Total Work Load			60
Total Work Load / 25 (h)			2.4
ECTS Credit of the Course			2

COURSE INFORMATON					
Course Title	***Code***	***Semester***	***L+P Hour***	***Credits***	***ECTS***
Research Methods	PHYS 514	1	3 + 0	3	10

Prerequisites	

Language of Instruction	English
Course Level	Postgraduate
Course Type	Compulsory
Course Coordinator	
Instructors	Prof.Dr. R. İnce
Assistants	
Internship	
Goals	To introduce research as an integral part of professional practice. thus as a way of thinking
Content	Scientific statements, formulating a research problem, collecting data, measurement, signal processing, the scientific method, mathematical models, research design, uncertainty, probability and statistics in research, probability theories, Bayes' theorem, ethics and responsibility in scientific research, writing a research proposal

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Gains an insight into research as a way of thinking and an integral part of professional practice	1	1,2	A
2) Perceives that research is an eight-step process and can conduct a plan of study and write a research proposal accordingly	5,1,6	1,2,4	A,C
3) Can clearly identify inductive and deductive scientific statements and is capable of utilising them to write a research report	2,10	1,2,4	A,C

4) Is capable of formulating a research report using a literature review to develop a draft, write about variables, list references and bibliography.	2,5,6	1,4	A,C
5) Is able to construct a hypothesis and formulate a research proposal accordingly	5	1,4	C
6) gains an understanding of how to improve research methodology and broaden their research base	6,10	1,4	A
7)Is able to differentiate between data collection methods and major approaches to information gathering	7	1,2,4	A,C
8) Is capable of considering ethical issues concerning (participants, confidentiality, information usage, method, and sponsoring organisations)	9	1,2	A
9) Gains skills in writing research proposals	8	1,4	C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Laboratory, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
	Scientific statements: justification and acceptance, Deductive &Inductive reasoning, Falsification, Peer review	Textbook
	Formulating a research problem: Basic research, Applied research, Evaluation research, Reviewing literature, Formulating a research problem, Identify variables, hypothesis construction	Textbook
	Collecting data: selecting a method, establishing validity and reliability of a research instrument, selecting a sample, ethical issues in data collection	Textbook
	Measurement: Measurement errors, Significant digits and rounding, Potential sources of error, Random and systematic errors, When to discard a measurement	Textbook
	Signal processing: Electronics, Interfacing, Instrumentation	Textbook

	Processing and displaying data	Textbook
	The scientific method and implementation into research: Observation, Hypothesis, Experimental testing, Predictions	Textbook
	Mathematical models: Empirical versus deterministic models	Textbook
	Research design: Components, Research design and your proposal, Checklists to assist you in preparing dissertation and thesis proposals	Textbook
	Uncertainty, probability and statistics in research: Probability concepts,(Probability theories and axioms, Bayes' theorem), Inductive logic and statistics	Textbook
	Ethics and responsibility in scientific research	Textbook
		Textbook
	Further Suggestions What else is needed to complete a thesis	Textbook
	Writing a research proposal	Textbook
16	FINAL EXAM	Textbook

RECOMMENDED SOURCES	
Textbook	1. Research Methodology: A Step-by-Step Guide for Beginners Paperback , 4th edn, 14 Jan 2014, Ranjit Kumar 2. Research Methodology: The Aims, Practices and ethics of science, Peter Pruzan
Additional Resources	Explorable website – www.explorable.com

MATERIAL SHARING	
Documents	Handouts
Assignments	Assignments every other week
Exams	1 Final

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term exam	2	30
Experiment	0	0
Assignment	6	10
Total		**40**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		60
CONTRIBUTION OF IN-TERM TRAINING TO OVERALL GRADE		40
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution Level					
		1	2	3	4	5	
1	Initiates and develops scientific research skills					x	
2	Strengthens scientific communication and writing skills				x		
3	Develops students' knowledge of measurement uncertainty			x			
4	Develops students' knowledge of instrumentation		x				
5	Introduces students to the scientific method				x		
6	Teaches students to identify and describe research problems and propose solutions using research methodology					X	
7	Enables students to design and perform experiments independently, collecting, analysing and interpreting data professionally				x		
8	Strengthens the ability to produce original, innovative proposals				x		
9	Brings awareness of ethical responsibilities		x				
10	Enables students to gain the skills to achieve lifelong learning		x				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	12	168
Mid-term examination	2	2	4
Homework	6	8	48
Final examination	1	3	3
Total Work Load			259
Total Work Load / 25 (h)			10.36
ECTS Credit of the Course			10