ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
ADVANCED MATERIAL SCIENCE NANOTECHNOLOGY PROGRAM
COURSE DESCRIPTION AND SYLLABUS

Course Title	Code	Semester	T+L Hours	Credit	ECTS
Modern Physics	AMN - 541	FALL-SPRING	3 + 0	3	10

Prerequisite Courses None

Type	Elective
Language	English
Coordinator	
Instructor	Mehmet Şahin
Adjunct	None
Aim	To understand light and its properties. To understand particle-wave relation. To learn quantum philosophy and its postulates. To learn Schrödinger equation and its applications to specific quantum mechanical structures, such as, quantum barriers, quantum wells, and quantum dots. To learn Bohr atom model
Learning Outcomes	• Learning properties of light. • Understanding particle-wave relation: de Broglie hypothesis, the Heisenberg uncertainty principle, etc. • Learning quantum philosophy: probability, properties of wave functions, etc. • Understanding of Schrödinger equation in one dimension • Determination of energy states and wave functions of quantum wells • Determination of energy states and wave functions of other systems • Solving of quantum barriers and tunneling mechanisms • Learning Bohr atom model and application to the hydrogen atom.
Course Content	The quantum theory of light, matter waves, quantum philosophy, Schrödinger equation in one dimension, solving of Schrödinger equation, tunneling phenomena, Bohr atom model

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topic	Preliminary Study
1	The photon concept, duality of the photon, and photon equations	The relevant articles from the literature
2	Black-body radiation, and photoelectric effect	The relevant articles from the literature
3	X-Rays	The relevant articles from the literature
4	Diffraction in single slit, interference in double slit, diffraction in crystal structure	The relevant articles from the literature
5	de Broglie Hypothesis, uncertainty principle, quantum philosophy, probability concept	The relevant articles from the literature
6	Postulates of quantum mechanics, expectation values and observables	The relevant articles from the literature
7	Properties of wave functions, operators in quantum mechanics	
8	Midterm	The relevant articles from the literature
9	Schrödinger equation, and its solution for specific cases	The relevant articles from the literature
10	Solution of Schrödinger equation for specific cases	The relevant articles from the literature
11	Solution of Schrödinger equation in a quantum well	The relevant articles from the literature
12	Solution of Schrödinger equation in a quantum dot	The relevant articles from the literature
13	Tunneling phenomena	The relevant articles from

		the literature
14	Bohr atom model and hydrogen atom	The relevant articles from the literature
15	Bohr atom model and hydrogen atom	The relevant articles from the literature
16	Final Exam	

SOURCES	
Lecture Notes	Lecture notes and presentations
Other Sources	Modern Physics, R.A. Serway, C.J. Moses, C.A. Moyer Concepts of Modern Physics, A. Beiser

COURSE MATERIALS SHARING	
Documents	Lectures notes are shared on the internet
Homeworks	Students will be given one homework each week
Exams	1 Midterm and 1 Final Exam

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	1	30%
Homework	10	30%
Quiz		
SUB-TOTAL	11	60%
Contribution of Semester Study		
Contribution of Final Exam	1	40%
TOTAL	12	100%

Course Category	
Sciences and Mathematics	70%
Engineering	30%
Social Sciences	0%

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

No	Program Qualifications	Contribution Level				
		1	2	3	4	5
1	Accessing knowledge, evaluating and interpreting information by doing scientific research in the field of Materials Science and Mechanical Engineering					x
2	Ability to use science and engineering knowledge for development of new methods in Materials Science and Mechanical Engineering				x	
3	To be able to understand and analyze materials by using basic knowledge on Materials Science and Mechanical Engineering					x
4	Design and implement analytical, modeling and experimental research	x				
5	Solve and interpret the problems encountered in experimental research			x		
6	Considering scientific and ethical values during the collection and interpretation of data	x				
7	Integrating knowledge of different disciplines with the help of scientific methods, and completion and implementation of scientific knowledge using data		x			
8	To gain leadership ability and responsibility in disciplinary and interdisciplinary team works	x				
9	To be able to contribute to the solution of social, scientific and ethical problems encountered in the field of Materials Science and Mechanical Engineering		x			
10	To be able to define, interpret and create new information about the interactions between various discipline of Materials Science and Mechanical Engineering		x			

*Increasing from 1 to 5.

ECTS / WORK LOAD TABLE			
Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	Each week	3	48
Out-of-class Study Time (Pre-study, practice)	15 weeks	3	45
Internet search, library work, literature search	15 weeks	3	45
Presentation	15 weeks	2	30
Homework	10 weeks		
Midterm	1	3	3
Final Exam	1	4	4
Total Work Load	10 weeks	14	175
Total Work Load / 30			
Course ECTS Credit			10