منهـــــج دراســـــة الماجســـتير
الفصـــل الدراســـي الأول

الرمز	عدد الوحدات	عدد الساعات الأسبوعية		الموضوع
		عملي	نظري	
501	3	-	3	حالة صلبة متقدم
502	3	-	3	نووية متقدم
503	3	-	3	فيزياء رياضية
504	3	-	3	ميكانيك الكم
505	2	-	2	فيزياء النانو
506	1	-	1	اللغة الانكليزية
	15	-	15	مجموع الساعات / الوحدات

Lecturer Name	Ass.Prof.Alaa abdul hakeim hamed
Subject Name	Advance Quantum Mechanics I / second course
Academic Year	2023- 2024
Credit Hours	3 hours in week

Students do study the following fields:

1. Tools and postulates of Q.M.
2. Angular momentum
3. Rotation and addition of angular momentum.
4. Equation of motion.
5. Dirac notation.

Course Outcomes:

1. The cours begins with the experimental basis of quantum mechanics, where we look at those atomic and subatomic phenomena which confirm the failure of classical physics at the microscopic scale and establish the need for a new

approach. Then come the mathematical tools of quantum mechanics such as linear spaces, operator algebra, matrix mechanics, and eigenvalue problems; all these are treated by means of Dirac's bra-ket notation. After that we discuss the formal foundations of quantum mechanics and then deal with the exact solutions of the Schrödinger equation when applied to one-dimensional and three-dimensional problems. We then look at the stationary and the time-dependent approximation methods.

2. to give a self-contained, yet concise, presenta tion of most issues of nonrelativistic quantum mechanics, and to offer a rich collection of fully solved examples and problems. This unified format is not without cost. Size! Judicious care has been exercised to achieve conciseness without compromising coherence and completeness.

Weekly Teaching Plan

Week 1, 2	The Schrödinger equation
Week 3,4	Momentum and the uncertainty principle
First Quiz	
Week 5,6	Mathematical tools of quantum mechanics
Week 7,8	The Hilbert space and wave functions
Second Quiz	
Week 9,10	Representation in Discrete bases
Week 11,12	Representation in continuous bases
Third Quiz	
Week 12, 13	The harmonic oscillator
Week 14,15	Angular momentum
Course Final Term Exam	

Computer Usage: Good
Teaching Techniques: theoretic
Assessment methods: E-Learning

References (text book) :
1-Quantum mechanics. by Powell & Crascman
2-Q.M. concepts & applications. by Zettili
3- Introduction to Quantum mechanics by J.Griffths

1. Course Name:	
Advanced Solid State Physics	
2. Course Code:	
3. Semester / Year:	
Second Semester/2024 – 2025	
4. Description Preparation Date:	
18-2-2024	
5. Available Attendance Forms:	
Presence	
6. Number of Credit Hours (Total) / Number of Units (Total)	
45 / 3 Units	
7. Course administrator's name (mention all, if more than one name)	
Name: Asset Prof. dr. Mahmood Ahmad Hamood Email: dr.mahmood@uomosul.edu.iq Name : Prof. dr. Mazin Ahmed Abed Mazin: mazinahmedabed@uomosul.edu.iq	
8. Course Objectives	
Course Objectives	1. The learn more advance things in solid state physics 2. Enabling the student to study some advanced specialization in solid state physics. 3. Developing the mental ability of the doctoral student by assigning him to solve a large number of questions and to be able to reach correct answers to specific questions that include the application of physical principles. 4. Developing the ability to formulate analytical questions 5. Preparing the student for the future in postgraduate studies. 6. Through the narration in each chapter , the student remains exposed to the question: Why? Or can you explain that? Each chapter concludes with a set of cognitive questions to develop t student's ability to apply the principles of solid state physics ir qualitative manner
9. Teaching and Learning Strategies	
Strategy	Method and procedure, which includes: 1- Presentation and detailed explanation 2- Problem posing and discussion And ask perceptive questions. 3- Teaching the student how to formulate and ask questions through the teacher's words. 4- Understanding current applications of solid state physics and exposure to new horizons of applications

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1,2	6	1.1.Introduction 2.1.Superconductivity 3.1. General properties of superconductor 4.1.Missiner Effect 5.1. Critical Tempera -ture , Field, Current 6.1. Type I and type II superconductors	Super conductor	The main teaching method is a combination of lecture-based methodsWhich elocution And detailed explanation And method Interactive Discussion Between the teacher And students Involving all students in the educational process	Discussion Individuality And collectivism Duties Exams, The quick one Exams Editorial search Assigning the student to give the lecture in place of the professor
3,4	6	7.1. Differences between type I and Type II superconductor 8.1. Penetration depth Summary Glossary of Important Terms Review Question Problems Quiz			
5,6	6	9.1. BCS Theory 10.1. Brothers London's Equation 11.1.Cooper Paries 12.1.Fiux quantization f 13.1.Critical parame -ter of super conductor 14.1.Effect of Magnetic Field			
7,8	6	15.1 Effect of Current 16.1.Isotopic Effect 17.1.Josephson Effect Summary Review Question Solve Problems Quiz			
9,10	6	2.1. Introduction	Magnetic		

		2.2.Original Phenome -non of Magnetism 2.3. Classification of Magnetic Material 2.4. Hound Rule 2.5. Langvan's Theory for Diamagnetic	Properties of Material		
11,12	6	2.6. Quantum Theory for Paramagnetic 2.7.Paramagnetic Susceptibility of conduction electrons 2.8.Propertiesof Ferromagnetic material 2.9.Properties-of Antiferromagnetic Material Summary Review Question Solve Problems Quiz			
13,14	6	3.1.Introduction 3.2.Different between Dielectric and conductor 3.3.Behaviour-of dielectrics in electric field 3.4. Non- polar dielectrics 3.5.Polar electrics			
13,14	6	3.6.Dielectric polarization 3.7.Dielectric constant 3.8. Three electric			

15	3	vector and their relation 3.9. Boundary condition at the dielectric surface Summary Review question Solve Problems	Semiconduct Device		

11.Course Evaluation
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	1. Introduction to Superconductivity , Second Edition by Michale Tankham, 2004. 2. Superconductivity An Introduction By , Roland Combescot 2022
Electronic References, Websites	

Lecturer Name	Mohammed Khayri Zeki Abed
Subject Name	Mathematical Physics
Academic Year	2023- 2024
Credit Hours	3

Students do study the following fields:

6. Vector Analysis, Coordinate Systems.
7. Tensor Analysis.
8. Group Theory, Gamma and Beta Functions.
9. Matrices.
10. Gamma and Beta Functions
11. Function of complex variable – Calculus and Residues.
12. Laplace Transformation, Fourier Series, Fourier Transform , Integral Transform.

Course Outcomes:

3. Learn mathematics and how to use in physics.

First Semester

Weekly Teaching Plan

Week 1, 2 (3-9-2023)	**Topics Covered**: **Vectors**: (addition, multiplication, associatation, etc.), Scalar, Vector Dot Product, Vector Cross Products, Triple Scalar and Triple Vector Product, (examples), Differentiation of Vectors, Directional Derivative, Gradient, Divergence, Curl, Successive applications of ∇ . (Questions for Practices)
Week 3,4	**Topics Covered** :Vector Integration(line, surface & volume integrals), Stock's Theorem, Gauss's Theorem, Potential Theory , Curvilinear Coordinates , Differential Operator, cylindrical, Spherical coordinates and their Transformations, (Examples and Solved Problems)
First Quiz	
Week 5,6	**Topics Covered** : **Tensor Analysis:** Covariant & Contravariant Tensors, Coordinates Transformations, Algebra Operations, Quotient Law, Fundamental Properties of Tensors, Symmetric and Anti-symmetric Tensors, Kronecker Tensor, pseudo Scalar and Tensors, Eigen values and Eigen vectors of second ordered Tensor, Dirac Delta Function.
Week 7,8	**Topics Covered**: **Group Theory** : Group Axioms(definition), Subgroups, classes, Symmetry Operations, Matrix Representation of Group, Examples of Groups, types of Groups, Irreducible Representations of groups (examples)
Second Quiz	
Week 9,10	**Topics Covered**: **Matrices**: Matrix Algebra, Type of matrices, Determinants, Inverse and Related Matrices, Elementary Transformations, Eigen values and Eigen vectors , Diagonalization of matrices, Functions of Matrices (examples)
Week 11,12	**Topics Covered**: **Gamma and Beta Functions**, Relation Between Beta and Gamma Functions (examples and Solved Problems)
Third Quiz	
Week 12, 13	**Topics Covered**: **Functions of complex Variables**: Complex numbers(review), limits, continuity and derivatives, Demoivers Theorem, Powes, Roots, Analytic Function , Cauchy Integral, Taylor's and Laurent's Theorems, Singularities, Calculus of Residues and Applications, Evaluation of real definite integral by contour, Integration Round unit circle.
Week 14,15 (15-1-2024)	**Topics Covered**: **Laplace Transformation, Fourier Series, Fourier Transform , Integral Transform.**
Course Final Term Exam	
Second Quiz	

Computer Usage:
Teaching Techniques:
Assessment methods:
References (text book) :

1- Peter O'Neil, 2003, Advanced Engineering Mathematics, 5th Edition.
2- Arfken, G. 1973, Mathematical Methods for Physicist (2nd ed.; Cambridge, MA: Academic Press).
3- Dass, H., K., 2009, Mathematical Physics , S. Chand ,India.


Physics Department
قسم الفيزياء
College of Science - Mosul University
كلية العلوم - جامعة الموصل