Jordan University of Science and Technology

Faculty of Science & Arts

Physics Department

PHY771 Solid State Physics

First Semester 2020-2021

Course Catalog

3 Credit Hours. Jordan University of Science and Technology Department of Mathematics and Statistics Course Syllabus Spring 2017/2018 Course Information Course Number: Phys 771 Course Name: Solid State Physics Credit Hours: 3 Contact Hours: 3 E-learning web address: www.just.edu.jo/~aobeidat Prerequisites: N/A Required or Elective or Selected Elective: Elective Instructor Information Coordinator: Instructor: Abdalla Ahmad Obeidat Office Hours: Office Location: NF 40 Instructors E-mail: aobeidat@just.edu.jo Course Catalog Course Description: (Give a brief description of the course as it appears in the study plan) Crystal structure, group theory, Many-particle systems, Free electron theory of metals, band theory, Electron Dynamics, Superconductivity and BCS Theory, magnetism, semiconductors Textbook: Textbook: (title, author, and year) Solid State Physics by N.W. Ashcroft and N.D. Mermin. References and Supplement Materials: 1. Introduction to Solid State Physics, by C. Kittel, John-Wiely & Sons. 2. Principles of the theory of Solids, by J.M. Ziman, Cambridge press. 3. The Oxford basics of Solid State Physics, Steven Simon, Oxford Evaluation Mid-term project 50 Final Exam 50 Outcomes of instruction: By the end of the course, students should be able to Show a basic knowledge and understanding of 1- Knowing Bravais structure, point group symmetry and character tables 2- Many body system and Fock space 3- Different models in electronic properties of metals and electrodynamics 4- Superconductivity as many-body problem 5- Magnetism and Magnetic Materials 6- Semiconductor physics Course Outline The recommended material is in N Ashcroft and N Mermein. (or any related reference will be useful for this material TOPIC (1) Crystal Structure and Group Theory Crystal Structure. Recommended Ch. 4 The Reciprocal Lattice. Recommended Ch. 5 Bragg?s Law, Geometrical Structure Factor. Recommended Ch. 6 Symmetry Operations, Point Groups and Space Groups, Schoenflies Notations. Recommended Ch. 7 Crystal Binding. Recommended Ch 20 TOPIC (2): Many-Body Theory in Condensed Matter: Recommended Ch 23, Appendices L, M and N will help We will consider the systems of Bosons and Fermions and will discuss Fock space. TOPIC (3): Free electron theory of Metals allowed energies, density of state, Fermi level, Fermi - Dirac Statics, electronic specific heat, thermionic emission, Electric and thermal conductivity, Boltzmann equation and electric resistivity. Ch. 2 Band Theory Origin of band structure, Bloch?s Theorem, Periodic potential, effective mass, reduced zone scheme. Ch. 8 Tight binding approximation. Ch.10 Orthogonal plane wave method, Pseudopotential method, Cellular method, Augmented Plane wave method. Ch.11 TOPIC (4): Electron Dynamics: Dynamics in an electric field, Dynamics in a magnetic field, skin effect, Cyclotron resonance, The de Hass-van Alphen effect. Ch.14 TOPIC (5): Superconductivity: Cooper pairs and BCS ? Theory, Energy gap. Here, topic (2 Relationship of the Course to the Mathematics Program Outcomes: Program outcomes a ? k ? Level (L, M, H) (a) an ability to apply knowledge of mathematics, science, and applied sciences ? H (b) an ability to design and conduct experiments, as well as to analyze and interpret data ? H (c) an ability to formulate or design a system, process, or program to meet desired needs (d) an ability to function on multidisciplinary teams (e) an ability to identify and solve applied science problems ? M (f) an understanding of professional and ethical responsibility (g) an ability to communicate effectively (h) the broad education necessary to understand the impact of solutions in a global and societal context (i) a recognition of the need for and an ability to engage in life-long learning (j) a knowledge of contemporary issues (k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

Text Book	
Title	Solid State Physics
Author(s)	N W Aschcroft and N W Mermin
Edition	1st Edition
Short Name	Text Book
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref (1)	Introduction to Solid State Physics	C Kittle	8th Edition	
Ref (2)	Principles of the Theory of Solids	J M Zeiman	1st Edition	

Instructor	
Name	**Prof. Abdalla Obeidat**
Office Location	PH3 L1
Office Hours	
Email	aobeidat@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 13:00 - 14:30 Room: منصة الكترونية

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2, 3	Topic (1) Crystal Structure and Group Theory	
Weeks 4, 5, 6	Many - Body Theory	
Weeks 7, 8, 9, 10	Free electron Theory, Band Theory	
Weeks 11, 12	Electron Dynamics	
Weeks 13, 14, 15	Superconductivity	

Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Know crystal structure and their point group symmetry [11, 15]	30%	Mid Term project
Learn knew approaches to solve N particle system [11, 15]	30%	Final Exam

Different electronic, thermal, chemical properties of solids Band theory, BCS, Eelectron dynamics [11, 15]	40%	Mid Term project, Final Exam

Relationship to Program Student Outcomes (Out of 100%)					
1	2	3	4	5	6
50				50	

Evaluation	
Assessment Tool	**Weight**
Mid Term project	50%
Final Exam	50%

Policy	
Solid State Physics	To introduce the problems in condensed matter physics and learn different approaches to solve these problems

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