MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Principles of Solid State Physics**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**Phy-441**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level			**Semester of Delivery**		
Administering Department	Physics		**College**		
Module Leader	Ziad Tariq Khodair		**e-mail**	ziad_tariq@uodiyala.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	-----		**e-mail**	-----	
Peer Reviewer Name	-----		**e-mail**	-----	
Scientific Committee Approval Date	31/12/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	Solid state physics	**Semester**	4

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. The purpose of the course is to introduce students to the basic principles of solid state physics and to develop required physical skills to solve problems in solid state physics, and other fields of experimental physics. 2. Understand the relation of structure to atomic bonding, and classify solids according to their crystal structure. 3. To understand the basic crystaliography , diffraction of X-rays by crystals, chemical bonds, defects in solids and lattice vibrations and specific heat capacity of solids.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain point group, Symmetry operations, and Space group 2. Defines Bravais lattice, Lattice, Unit cell and Miller indices 3. Explains Crystal systems, Crystal planes and directions, Diffraction of waves by crystals and Bragg's law. 4. Knows Reciprocal space, Reciprocal lattice, Construction of reciprocal lattice, Reciprocal lattice vectors and Diffraction condition, and Laue equations and Brillouin zone. 5. Explain Simple cubic (SC), Body centered cubic structure (BCC), Body centered cubic (BCC) structure, Face centerd cubic (FCC) structure, and Hexaconal close packed (HCP) structure. 6. Can explain bonding types in crystals, such as: Ionic or electrovalent bond, Covalent bond, Metalic bond, Van der Waals bond,and Hydrogen bond. 7. Understand the properties of Defects in solids, Crystal imperfections, Point defects, Line defects, Surface defects, and Effects of crystal imperfections. 8. Can explain Phonons and Thermal properties of phonons as follows: Explains Phono-crystal interactions, Monoatomic and diatomic linear chain and w-k relationship, Explains Optic and Acoustic phonon modes, Defines Thermal properties of phonons, heat capacity of phonons, Density of states and Density of states models of Debye and Einstein.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Part 1 An introduction to crystal structure. Basic concepts of crystallography. Bravais lattice. Crystal planes and Miller indices. Types and important of crystal structures. Part 2 X-Ray diffraction- Introduction. Bragg's law. Reciprocal lattice.

	Interpretation of Bragg's law. The powder method (Debye- Scherrer method). Part 3 Chemical bonds- Introduction Review of atomic structure. Primary bonds. Secondary bonds. Defects in solid (Types). Part 4 Lattice vibrations and Specific heat capacity of solids. Vabrations of monoatomic and diatomic lattice in one dimensions. Specifof solids heat capacity of solids according : Dulong and Petit' law, Einstein's thory , and Debye's theory of specific heat.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to recognize the fourteen Bravais lattices and seven systems of crystalline structures, the concept of Miller indices for crystal planes and directions, List and describe the types of crystal defects and interatomic bonds in solids. List and describe chemical bonds, List the different methods of X-ray diffraction and their direct relation to the reciprocal lattice concept, understand lattice vibrations and the specific heat capacity of solids.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation

تقييم المادة الدراسية

As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	4 and 10	LO #1, #2, #3 and #4, #5, #6, #7, #8
	Assignments	2	10% (10)	5 and 12	LO #1, #2, #3 and #4, #5, #6, #7, #8
	Project	1	10% (10)	Continuous	All
	Report	1	10% (10)	14	LO #1, #2, #3 and #4, #5, #6, #7, #8
Summative assessment	Midterm Exam	2hr	10% (10)	8	LO #1 - #6
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	An introduction to crystal structure.
Week 2	Basic concepts of crystallography and Bravais lattice
Week 3	Crystal planes and Miller indices
Week 4	Types and important of crystal structure
Week 5	Diffraction of X-rays by crystals (Bragg's law and crystal structure)
Week 6	Expermental method of X-ray diffraction, and reciprocal lattice
Week 7	An introduction in chemical bonds, Primary and secondary bonds
Week 8	Mid-term Exam
Week 9	An introduction in deffects in solids
Week 10	Types and effects of crystal imperfections
Week 11	An introduction in Lattice vibration and phonons
Week 12	Vibration of monatomic lattice and Vibration of diatomic lattice
Week 13	An introduction in thermal properties of solids Classical model of lattice energy
Week 14	The Einstein's model for specific heat
Week 15	Debye model for specific heat

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	**Material Covered**
Week 1	Crystals
Week 2	NaCL crystal, KCL crystal
Week 3	Bragg's law
Week 4	Crystal defect 1
Week 5	Crystal defect 1
Week 6	Thermal conductivity 1
Week 7	Thermal conductivity 2

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Elementary Solid State Physics: Principles and Applications Addision –Wesley Puplishing Company, First edition (1975) by M. Ali Omar	Yes
Recommended Texts	1. Introduction to Solid State Physics, Charles Kittle, John Wiley & Sons, Inc, New York USA (1996). 2. Solid State Physics, J. S. Blakemore, 2nd edition, Cambridge university press 1985. 3. Solid state physics , MJP Publishers, India, 1st edition (2013)	Yes No yes
Websites	https://www.physics.udel.edu/~bnikolic/teaching/phys624/lectures.html https://archive.nptel.ac.in/courses/115/105/115105099/	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.