Kingdom of Saudi Arabia
National Commission for
Academic Accreditation & Assessment

المملكـة العربيـة السعوديـة
الهيئـــة الوطنيـــة للتقويـم
والاعـتـمـاد الأكـاديـمـي

كلية العلوم التطبيقية
Faculty of Applied Sciences

Kingdom of Saudi Arabia
The National Commission for Academic Accreditation & Assessment

T6. Course Specifications (CS)

Course title: Solid State Physics (1)

Course code: 23064371-4

Course Specifications

Institution: **Umm AL – Qura University**	Date : **18/1/1439**
College/Department : **Jamoum University College – Physics Department**	

A. Course Identification and General Information

1. Course title and code: **Solid State Physics (1) 23064371-4**
2. Credit hours: **4 hrs.**
3. Program(s) in which the course is offered. **BSc Physics**
(If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
One of the staff members
5. Level/year at which this course is offered : **4st Year / Level 7**
6. Pre-requisites for this course (if any) : **Quantum Mechanics 1 23063323-4**
7. Co-requisites for this course (if any) : ---
8. Location if not on main campus: **Al-Jamoum**
9. Mode of Instruction (mark all that apply)

a. traditional classroom	✓	What percentage?	100%
b. blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. What is the main purpose for this course?

After completing this course student should be able to:

1. Define the principles and concepts of solid state physics.
2. Compare the origin of bonding in materials
3. Define the lattice planes & directions.
4. Explain the different types of defects in solid state and understand how it affect the physical properties of matter.
5. Explain how X-Rays Diffraction can be used in studying the solid structure.
6. Define phonons in crystals and distinguish between their different modes
7. Choose the right formulas to calculate specific heat & thermal conductivity of the lattice.
8. Recognize the main drawbacks of the free electron model in metals.
9. Identify: Bloch's theorem, Brillouin zones & Fermi surface in metals.
10. Classify different types of solid according to The Band Theory.
11. Distinguish between intrinsic & extrinsic Semiconductors and know their properties and applications.
12. Recognize the idea behind the Superconductivity phenomenon and be aware of its applications.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

1- Explain the strategy of the course in the beginning of the semester
2- Outlines of the physical laws, principles and the associated proofs.
3- Encourage the students to see more details in the international web sites and reference books in the library.
4- Discussing some selected problems in each chapter.
5- Renew the course references frequently
6- Frequently check for the latest discovery in science

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

The course will cover An introduction to the physics governing the different types of binding in solid state materials, Geometry of Solids and crystalline state of matter, Reciprocal Lattice, Brillouin zone, Modern theories describing lattice vibrations, Energy bands, X-Ray Diffraction, Electrons in solids, and Optical properties of solid materials. Free electron theory in metals, band theory, thermal properties of solid materials, Lecture 4 hours..

1 Topics to be Covered

Topics	No of Weeks	Contact hours
❖ **The atomic Theory and Binding Forces**	**1.5**	**6**

1- Review of atomic structure 2- Atomic binding and band theory 3- Binding forces between atoms 4- Lattice Energy Calculations 5- Types of bonds 6- Nucleation and growth kinetic 7- Experimental methods of crystal growth		
❖ **Crystal Structure** 1- Long range and short rang order 2- The crystalline state 3- Basic definitions of crystallography 4- The seven crystal systems 5- Wigner Seitz primitive cell 6- Symmetry elements of crystals 7- Important plane systems in a cubic crystals 8- Miller's indices for crystal planes	**1.5**	**6**
❖ **Crystal Properties** 1- Crystal Directions and distance between crystal plans 2- Zone , Zone Axis and angles between zones 3- Atomic structure of crystals 4- Cubic and hexagonal close-packed 5- Characteristic of FCC and BCC structure 6- The crystal structure of some simple crystals	**1.5**	**6**
❖ **Structural Defects in Crystals** 1- Point defects and Free energy of a crystal 2- Point defects in ionic crystals 3- Line defects and types of dislocation 4- Planer defects 5- Determination of vacancies concentration and the activation energy	**1**	**4**
❖ **X-Rays Diffraction in Crystals** 1- Used rays in studying crystal structure 2- Generation and properties of X-rays 3- X-Rays scattering from an atom 4- X-Rays scattering from a crystal and Reciprocal lattice	**1.5**	**6**
❖ **Lattice Vibrations** 1. Elastic waves 2. Modes of vibrations and density of states of a continuous medium 3. The phonon 4. Elastic and non-elastic scattering 5. Lattice waves of one-atomic linear chain 6. Vibration Modes of 1D diatomic	**1**	**4**

❖ **Free electrons in metals** 1. The Electrical Conductivity in Metals 2. The Specific Resistance in Metals 3. The Electrical and Thermal Conductivity in Metals 4. The Quantum Theory in Free Electrons 5. Ground State Property of Free Electrons 6. Electronic Specific Heat of Metals 7. Some Problems in Free Electron Model	**2**	**8**
❖ **Band theory in the solids** 1. Origin of the Bands in Solid 2. Periodic Potential 3. Bloch Function 4. Crystal Structure in One-Dimensional Atomic Chain 5. Brillouin Zones 6. Band Theory in Free Electron Model 7. Density of States 8. The Effective Mass 9. Concept of Holes 10. Fermi Surfaces	**2**	**8**
❖ **Thermal properties of solid materials** 1. Specific heat: 2. Einstein model for specific heat, 3. Debye model for specific heat, 4. Heat capacity of solid body, 5. Heat capacity of electron gas, 6. Thermal conductivity of solid body, 7. Thermal expansion	**3**	**12**
	15 weeks	**60hrs**

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	**60**	**15**				**75**
Credit						

3. Additional private study/learning hours expected for students per week. 4

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.
First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table).
Second, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes.
Third, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Define the physical quantities, physical phenomena, and basic principles.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: Board, Power point. 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Discussions during the lectures Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Oral exams .
1.2	Describe the physical laws and quantities using mathematics		
2.0	**Cognitive Skills**		
2.1	Apply the laws of physics to calculate some quantities.	1. Preparing main outlines for teaching. 2. Following some proofs. 3. Define duties for each chapter	1. Exams (Midterm, final, quizzes) 2. Asking about physical laws previously taught
2.2	Solve problems in physics by using suitable mathematics.		
2.3	Analyse and interpret quantitative results.		

2.4	Apply physical principle on day life phenomena.	4. Encourage the student to look for the information in different references. 5. Ask the student to attend lectures for practice solving problem.	3. Writing reports on selected parts of the course. 4. Discussions of how to simplify or analyze some phenomena.
2.5	Derive the physical laws and formulas.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	• Search through the internet and the library. • Small group discussion. • Enhance self-learning skills. • Develop their interest in Science through : (lab work, visits to scientific and research institutes).	• Evaluate the efforts of each student in preparing the report. • Evaluate the scientific reports. • Evaluate the team work in lab and small groups. • Evaluation of students presentations.
3.2	Work effectively in groups and exercise leadership when appropriate.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Communicate effectively in oral and written form.	• Incorporating the use and utilization of computer, software, network and multimedia through courses • preparing a report on some topics related to the course depending on web sites	• Evaluating the scientific reports. • Evaluating activities and homework
4.2	Collect and classify the material for the course.		
4.3	Use basic physics terminology in English.		
4.4	Acquire the skills to use the internet communicates tools.		
5.0	**Psychomotor (NA)**		

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.)																
Course LOs #	**Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)**															
	1.1	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**3.1**	**3.2**	**4.1**	**4.2**	**4.3**	**4.4**	**5.1**	**5.2**
1.1	✓															
1.2		✓														
1.3																
2.1				✓												
2.2					✓											
2.3						✓										
2.4							✓									
2.5								✓								
3.1									✓							
3.2										✓						
4.1											✓					
4.2												✓				
4.3													✓			
4.4														✓		
5.1																
5.2																

6. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Exercises & Home works	All weeks	10 %
2	Participation	All weeks	10 %
3	In-Class Problem Solving	All weeks	10 %
4	Midterm 1	6th week	10 %
5	Midterm 2	12th week	10 %
6	Final Exam	16th week	50 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
Each student will supervise by academic adviser in physics department and the time table for academic advice were given to the student each semester. (4hrs per week)

E Learning Resources

1. List Required Textbooks
   1- Charles Kittel, Introduction to Solid State Physics 7th Ed
   2- Walter A. Harrison, Solid State Theory , Dover edition 1979
2. List Essential References Materials (Journals, Reports, etc.)
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
   1- H.P. Myers, Introduction to Solid State Physics, 2nd Ed, 2009 Taylor & Francis
   2- Elementary Solid State Physics by M. Ali Omar, 1997
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
   - http://www.phys.lsu.edu/~jarrell/COURSES/SOLID_STATE_HTML/course_solid.html
   - http://www.encyclopedia.com/topic/solid-state_physics.aspx
   - http://www.physics.byu.edu/research/condensed
   - http://web.utk.edu/~tbarnes/website/cm/cm.html
   - http://www.answers.com/topic/solid-state-physics
   - http://www.answers.com/topic/solid-state-physics
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
2. Computing resources (AV, data show, Smart Board, software, etc.) In each class room there is a data show, and board.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) Each Class room require a TV screen at least 65 inch-and smart, and double layer white board.

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching • Questionaries • Open discussion in the class room at the end of the lectures
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3 Processes for Improvement of Teaching • Preparing the course as PPT. • Using scientific flash and movies. • Periodical revision of course content.
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) • The instructors of the course are checking together and put a unique process of evaluation. • Check marking of a sample of papers by others in the department. • Feedback evaluation of teaching from independent organization. • Independent evaluation by another instructor that give the same course in another faculty. • Evaluation by the accreditation committee in the university.
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. 1- The following points may help to get the course effectiveness • Student evaluation • Course report • Program report • Program Self study 2- According to point 1 the plan of improvement should be given.