هيئة تقويم التعليم
Education Evaluation Commission
المركز الوطني للتقويم والاعتماد الأكاديمي
National Center for Academic Accreditation and Evaluation

COURSE SPECIFICATIONS
(CS)

Solid State Physics

PHYS 371

June 2018

Course Specifications

Institution: King Saud University	Date : 2018
College/Department: College of Science, Physics &Astronomy Department	

A. Course Identification and General Information

1. Course title and code: Solid state physics (PHYS 371)
2. Credit hours: 3(3+0+0)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Physics and other science and engineering programs
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: 6 level
6. Pre-requisites for this course (if any): Modern Physics (PHYS 353)
7. Co-requisites for this course (if any):
8. Location if not on main campus 1. Main campus in Diriyah , College of Science, Department of Physics & Astronomy

9. Mode of Instruction (mark all that apply)

a. traditional classroom	√	What percentage?	80%
b. blended (traditional and online)	√	What percentage?	20%
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? a) explain the basic concepts of the structural and physical properties of materials, b) recognize the main theories and laws of solid state physics. c) outline the crystal structure, reciprocal lattice and Brilouim zones, bonds in Crystals, free electron theory, band theory, phonons and lattice vibrations, thermal properties of insulators. d) specify the applications of different materials.
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) • Assigning extra hours for solving selected problems that are of particular interest. • The course material is discussed during tutorials • Using the internet resources to access particular advanced topics

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

Course Description: Definition of the Solid State and Crystal Growth, Crystalline Amorphous and Nano solids, Atomic Binding, Crystal Lattices and Structures, Miller indices Elastic Constants, Crystal Defects, Fourier Analysis of Periodic Structures, Reciprocal Lattice, X-ray Diffraction, Brillouin Zones, Lattice Vibrations and Phonons, Thermal properties of Solids, Einstein and Debye Models of Heat Capacity, Phonon Density of States, Planck Distribution. Free Electron (Fermi gas) model, Electron Density of States, Electrical, thermal and optical properties of the Electron Gas.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
A survey of solid state physics and crystal structure: • Definitions: lattice, basis, crystal structure, primitive lattice cell, volume of cell; Bravais lattice. • Fundamental types of lattices (2D and 3D types). • index systems for crystal planes, Lattice Planes and Miller indices. • Simple crystal structures, Hexagonal close-packed (hcp) structure.	3	9
Determination of crystal structure, reciprocal, and Bravais lattice: • Determination of crystal structure: Bragg law, diffraction condition, Lau condition. • Bravais lattice , reciprocal lattice vectors, Lattice Planes and Miller indices, Brillouin zone	2	6
Crystal binding and elastic constants: • Energy calculations, the potential of energy function. • Covalent binding, • Ionic binding.	2	6

Phonons: • Phonon I: Crystal vibration, atoms vibration, normal modes • Phonon II: Thermal properties: Thermal properties	3	9
Free electron: • Fermi-Dirac distribution, • Energy levels, Heat capacity. • Failure of free electron model	2	6
Energy bands: • Bloch theorem, • Kronig-Penney model. • Metal and insulators	2	6
Semiconductor: • Band gap, holes and electrons, effective mass. • Homogeneous and inhomogeneous semiconductor.	1	3

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	45					45
Credit	45					45

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

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**		
	•The student should memorize the basic concepts of	- Lecturers and debates	- Exams

	solid state. •The student should recognize the basic concepts and methods of crystal structure and reciprocal lattice, Baravis Lattice. •The student should recognize the energy bands, phonons, free electrons, crystal binding •The student should define the methods of solid state physics to solve the semiconductor phenomena and their applications	- Homework assignments - Lab demonstrations - small group work	-peer evaluations - analytical reports -long and short essays - group reports
2.0	**Cognitive Skills**		
	- To explain the daily life applications of the studied topics. - To explain the most famous and useful instruments build on the studied topics. - To recognize how technology is built from simple to advanced present states - To summarize some interesting experiments and applications in the field of the studied course.	- whole group and small group discussions - Case studies - individual presentation - brainstorming	-portfolios -discussion forums -interviews -debates
3.0	**Interpersonal Skills & Responsibility**		
	- writing reports - To modify the English language - To demonstrate solving problems - To illustrate Searching on the internet - choosing the material of the course	-Guest speakers - whole group and small group discussions - research activities -projects	-Individual and group presentations -speeches - posters - case studies
4.0	**Communication, Information Technology, Numerical**		
	- To illustrate how to Communicate with others: the lecturer – students in the class - To interpret Information Technology through the Internet and to assess the computer skills - To evaluate the Numerical skills through: solving problems- computation – data analysis – feeling physical reality of results.	- memorization - projects - whole group and small group discussions - brainstorming	- log books - analytical reports - graphic organizers - graphs and tables - group presentations
5.0	**Psychomotor**		
	Not applicable	Not applicable	Not applicable

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**		**2.1**		**3.2**		**4.1**	
1.1									
2.1									

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	First Mid-term exam		15%
2	Second Mid-term exam		15%
3	Home works, assignments, and experimental		30%
4	Final Exam		40%

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) • Office hours 3 hr/ week

E Learning Resources

1. List Required Textbooks 1- "An Introduction to Solid States Physics", C. Kittle, 8th Edition, John Wiley & Son Inc (2005). 2- "Solid State Physics, Ashcroft & Mermin", 1st Edition, Harcourt Asia Pte Ltd (1976). 3- "Introduction to condensed matter Physics." Feng Duan & Jin Guojun, (World Scientific, 2005). 4- The Oxford solid state basics, Steven H. and Simon, Oxford university press 2016
2. List Essential References Materials (Journals, Reports, etc.) 1- "An Introduction to Solid States Physics", C. Kittle, 8th Edition, John Wiley & Son Inc (2005). 2- The Oxford solid state basics, Steven H. and Simon, Oxford university press 2016
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) 1- "An Introduction to Solid States Physics", C. Kittle, 8th Edition, John Wiley & Son Inc(2005). 2- "Introduction to condensed matter Physics." Feng Duan & Jin Guojun, (World Scientific, 2005). 3- The Oxford solid state basics, Steven H. and Simon, Oxford university press 2016
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. Websites on the internet that are relevant to the course topics

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. Multimedia associated with the text book and the relevant websites

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.) • Lecture room with at least 25 seats
2. Computing resources (AV, data show, Smart Board, software, etc.) • Computer room containing at least 15 systems
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) • Availability of demonstrative materials relevant to the course material • Safety facilities

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching • Course evaluation by student • Students- faculty meetings
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Peer consultation on teaching • Departmental council discussions • Discussions within the group of faculty teaching the course
3 Processes for Improvement of Teaching • Conducting workshops given by experts on the teaching and learning Methodologies. • Periodical departmental revisions of its methods of teaching. • Monitoring of teaching activates by senior faculty members.
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) • Providing samples of all kinds of assessments in the departmental course portfolio of each course • Assigning group of faculty members teaching the same course to grade the same questions for various students.
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • The course material and learning outcomes are periodically reviewed and the changes to be taken are approved in the departmental and higher councils. • The head of department and faculty take the responsibility of implementing the proposed changes in the course materials.

Name of Instructor: _____

Signature: _____ Date Report Completed: _____

Name of Field Experience Teaching Staff _____

Program Coordinator: _____

Signature: _____ Date Received: _____