



The University of Southern Queensland

## Course specification

### Description: Quantum and Solid State Physics

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
PHY	3301	30352	1, 2004	ONC	1.00	TWMBBA

<b>Academic group:</b>	FOSCI
<b>Academic org:</b>	FOS002
<b>Student contribution band:</b>	2
<b>ASCED code:</b>	010301

### STAFFING

Examiner: Alfio Parisi  
Moderator: Jeff Sabburg

### REQUISITES

Pre-requisite: PHY2202 and MAT1102 and (PHY1911 or PHY1103)

### RATIONALE

This course provides firstly a knowledge of quantum physics necessary to explain the behaviour of atoms and sub-atomic particles and secondly a description of the physics of solids.

### SYNOPSIS

The first part of this course discusses topics necessary for the student to gain an understanding of the experimental foundations of quantum physics along with the necessary theory to explain the behaviour of atoms and sub-atomic particles and how this relates directly to larger scale phenomena and applications. The second section of this course examines the properties of matter in the solid state and seeks to understand them in terms of the concepts of physics that students will have encountered in their previous studies. A series of practical exercises are undertaken to demonstrate some of the principles involved.

### OBJECTIVES

On successful completion of this course students will be able to:

- demonstrate an understanding of current concepts and results of quantum theory and the physics of solids;
- display knowledge on the application of the theories;
- demonstrate skills and knowledge required to perform laboratory experiments safely with appropriate equipment.

## TOPICS

Description	Weighting (%)
1. Quantum Physics: Experimental Foundations, Black body radiation, Planck's constant, Photoelectric effect, Compton Effect, Wave Equation, Schrodinger's equation, Free particle, Particle in a box, Penetration of a potential barrier, Linear harmonic oscillator, Operators and expectation values, Uncertainty Principle Applications, Hydrogen atom, Optical spectra, X-Ray spectra, Lasers and Holography, Scanning Tunnelling Microscope.	50.00
2. Solid State Physics: Structure of Crystalline Solids, Theories of Conduction and Magnetism, Energy Bands in Solids, Quantum Theory of Conduction, Semiconductor Devices	50.00

### **TEXT and MATERIALS required to be PURCHASED or ACCESSED:**

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

Parisi, A.V. & Sabburg, J. 2004, *Laboratory Manual for Quantum and Solid State Physics*, USQ Publication, Toowoomba.

Rudden, M.N. & Wilson, J. 1993, *Elements of Solid State Physics*, 2nd edn, John Wiley, Chinchester, New York.

Serway, R.A., Moses, C.J. & Moyer, C.A. 1997, *Modern Physics*, 2nd edn, Saunders College Publishing, Forth Worth.

### **REFERENCE MATERIALS:**

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Reviews of Modern Physics.

Park, D. 1992, *Introduction to the Quantum Theory*, McGraw-Hill, New York.

## STUDENT WORKLOAD REQUIREMENTS:

ACTIVITY	HOURS
Examinations	4.00
Laboratory or Practical Classes	14.00
Lectures	22.00
Private Study	81.00
Report Writing	36.00
Tutorial	13.00

## ASSESSMENT DETAILS

Description	Marks out of	Wtg(%)	Due date
CONTINUOUS LAB REPORTS	15.00	15.00	02 Mar 2004 (see note 1)
2 HR RESTRICTED TEST	35.00	35.00	02 Mar 2004 (see note 2)
1.5 HR RESTRICTED EXAM	50.00	30.00	END S1 (see note 3)
1HR CLOSED EXAM	20.00	20.00	END S1 (see note 4)

### NOTES:

1. Examiner to advise due dates of the Continuous Lab Reports (Quantum only)
2. Examiner to advise date of the 2hr Restricted Test
3. Examination dates will be available during the Semester. Please refer to the examination timetable when published.
4. This exam will take place immediately after the restricted exam (based on three lectures and three practicals relating to the "Structure of Crystalline Solids").

## IMPORTANT ASSESSMENT INFORMATION

### 1 Attendance requirements:

It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration. To maximize their chances of satisfying the objectives of the practical component of the course, students should attend and actively participate in the laboratory sessions in the course.

### 2 Requirements for students to complete each assessment item satisfactorily:

To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available for each assessment item.

- 3 Penalties for late submission of required work:  
If students submit assignments after the due date without prior approval then a penalty of 20% of the total marks available for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:  
To be assured of receiving a passing grade a student must attempt all of the summative assessment items, achieve at least an aggregated mark of 50% of the total marks allocated for the examinations, achieve an aggregated mark of at least 50% of the total marks allocated for the assignments, and at least 50% of the available weighted marks for the summative assessment items.
- 5 Method used to combine assessment results to attain final grade:  
The final grades for students will be assigned on the basis of the weighted aggregate of the marks obtained for each of the summative assessment items in the course.
- 6 Examination information:  
In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); calculators which cannot hold textual information (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination. With the Examiner's approval, candidates may, take an appropriate non- electronic translation dictionary (but not technical dictionaries) into the examination. This will be subject to perusal and, if it is found to contain annotations or markings that could give the candidate an unfair advantage, it may be removed from the candidate's possession until the appropriate disciplinary action is completed. Candidates may have access to any material during the Open examination except the following: electronic communication devices, bulky materials, devices requiring mains power and material likely to disturb other students.
- 7 Examination period when Deferred/Supplementary examinations will be held:  
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.
- 8 University Regulations:  
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

## **ASSESSMENT NOTES**

- 9 Students must retain a copy of each item submitted for assessment. this must be produced within 24 hours if required by the Examiner.
- 10 In order to attend laboratory classes, students must provide and wear appropriate personal protective equipment. This shall include a laboratory coat, closed in shoes, and safety glasses. Such equipment must be approved by supervising staff. Failure

to provide and wear the appropriate safety equipment will result in students being excluded from classes.