UNIVERSITY OF SALFORD FORM MS

MODULE SPECIFICATION

Please contact your College Learning and Teaching Team for guidance completing this form:
Colleges of Arts & Social Sciences and of Business & Law – cass-tandlteam@salford.ac.uk
College of Health and Social Care – chsc-teaching@salford.ac.uk
College of Science and Technology – cst-tl@salford.ac.uk

This form is available to download from http://www.governance.salford.ac.uk/page/aqa_forms).

Date of completion of this version of Module Specification: 13/01/2016

Date of approval by PARP: 26/01/2016

1. Module Title: (Full title and short title no more than 30 characters)	2.CRN:
Advanced Quantum Mechanics	34048

3.University module code:	4.HESA/JACS subject area code[i]:
F300 M0007	F300,F310,F321,F200

5.Level:	6.Credit Value:	7.ECTS Value[ii]:	8.Length of module in semesters:	9.Month(s) in which to be offered[iii]:
Level 7	30	15	1	September

10.Module Status[iv]	11.Title of Module being replaced *(if any):*	12.With effect from[v] (academic year):
Existing		September 2016

13.Originating School:	14.Module Leader(s)
School of Computing, Science & Engineering	Professor Stanko Tomic

15.Programme(s) in which to be offered[vi]:

MPhys (Hons) Physics
MPhys (Hons) Physics with Professional Experience
MPhys (Hons Physics with Acoustics
MPhys (Hons) Physics with Acoustics with Professional Experience
MPhys (Hons) Physics with Studies in North America
MPhys (Hons) Physics with Studies in North America with Professional Experience
MSc Renewable Energy Materials

This module has a subject JACS code that requires applicants from outside the European Economic Area (EEA) and Switzerland to hold an Academic Technology Approval Scheme (ATAS) certificate.
This requirement also extends to any programme to which this module is attached.

The list of JACS codes for which an ATAS certificate is required can be found via the following link:

https://www.gov.uk/government/publications/taught-masters-student-jacs-codes

16.Pre-requisites *(between levels):* None	17.Co-requisites *(within a level):* None

18.Indicative learning hours (breakdown of hours required)[vii] 300

Lecture	48	Fieldwork	
Seminar		External visits	
Tutorial	12	Work based learning	
Project supervision		Guided independent study	216
Demonstration Practical classes and workshops	24	Placement	

Supervised time in studio/workshop		Year abroad	
Other – please specify[viii]			

19.Percentage of module taught by School(s) other than originating School: 0%

20.Aims of Module[ix]: (maximum of 5)

1. To develop a knowledge and systematic understanding at the forefront of the area of Materials Theory including the origin and limitations of the associated laws.
2. To develop expertise in advanced analytical and numerical problem solving skills in the area of Materials Theory.
3. To develop skills in the use of materials modelling techniques to predict and understand the properties of materials.

21.Intended Learning Outcomes[x]

Knowledge and Understanding (maximum of 5)[xi]
On successful completion the student will be able to:

1. Demonstrate an expert critical understanding of the laws and their origins at the forefront of the area of Materials Theory.
2. Demonstrate an ability to specify problems using theoretical principles and solve such problems using analytical and numerical means.
3. Demonstrate an expert critical understanding of methods of materials modelling and apply such methods to solve problems.

Transferable/Key Skills and other attributes (maximum of 5)
On completion the student will have had the opportunity to:

4. Demonstrate communication through written material.
5. Demonstrate analytical and numerical problem solving skills.
6. Demonstrate computer based problem solving skills.

22. Module mark calculation: Method A

23.Assessment components (in chronological order of submission/examination date)
Denote final assessment component in box marked **final assessment component (99)**

Type of assessment	Identify which ILO is met by number[xii]	Weighting %	Duration	Word count	Component pass required[xiii]	E Submission	Assessment organised by
Portfolio (Set Exercises and Report)	1,3,4,6	40			No	Yes	School
					Choose an item.	Choose an item.	Choose an item.
Final assessment component (99) Examination	1,2,4,5	60	3 hours		No	No	SID

24. Is ethical approval for the module required?	No	25. Is ethical approval for an assessment component required?[xiv]	No

26.Learning, teaching and assessment strategies:

The module is taught through a combination of lectures, tutorial classes and laboratory classes.

Tutorial classes facilitate the formative testing of students understanding through problem solving as well as preparing students for the exam.

The portfolio element is a combination of computer based laboratory exercises and associated write ups. Initial instruction is given in the use of relevant software packages followed by demonstrator support to facilitate completion of exercises. Formative assessment is conducted via demonstration of laboratory skills appropriate to the exercises.

Summative assessment is conducted via observation and report.

Formative assessments conducted in tutorial classes are designed to enhance students' problem solving skills.

Examinations are used to assess the students' knowledge and understanding of concepts, fundamental principles and problem solving skills.

The methodology taught in the computer laboratory equips students to pursue computer simulation research projects.

27.Syllabus outline:

Revision of basic principles of Quantum Mechanics
Many election Quantum Mechanics
Helium atom
Interpretation of singlet and triplet states
Exchange-correlation hole
Perturbation theory of degenerate states
Hartree theory and Hartree-Fock theory
Thomas-Fermi-Dirac theory
Density functional theory
Matrix representation
Localised basis and directional integrals
Plane waves representation and the concept of pseudo potentials

Independent Electron Approximation
Free electron Fermi gas, density of states,
Heat capacity of electrons, electrical conduction in metals
Nearly free electron model, band gap, Kronig-Penney model, Bloch function,
Electronic band structures
Semiconductors, doping, n and p type, effective mass, Hall effect and cyclotron resonance.
The harmonic approximation and the quantum harmonic oscillator
Lattice vibrations and phonons
Lattice heat capacity
Lattice thermal conductivity

28.Indicative texts and/or other learning materials/resources[xv]:

After initial approval, up to date reading lists can be accessed at https://salford.rl.talis.com/index.html
Note: This replaces the LaSU reading lists from September 2015 onwards.

For Office Use only:

Teaching and Learning Team Comments:	

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i See UoS guidance notes on selecting JACS codes (http://www.planning.salford.ac.uk/jacs_codes/) see HESA JACS Codes webpage http://www.hesa.ac.uk/index.php/content/view/356/233/

ii The ECTS value is half of the module credit value

iii Please indicate the month (s) in which delivery of the module will commence.

iv Amendments to the title or credit value constitute a new module.

v If the delivery month of the module is to be available for different intakes of a programme, please indicate this here. E.g. Module effective from Sept 2014 – to state the module is to be available for Sept 2014 intake & Feb 2014 intake.

vi The module will only be attached to programmes specified in this section. Any approved module can be available as a stand alone module.

vii These categories are used for the Key Information Set which currently applies only to full time undergraduate students only but please include for all students – for more information including definitions see http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/contact_hours.pdf and http://www.hesa.ac.uk/component/option,com_studrec/task,show_file/Itemid,233/mnl,13061/href,Calculations_methods.html/#LearningandTeaching

viii The 'other' category should not be used for learning undertaken by full undergraduate students as 'other' is not used in KIS categories

ix The aims should express the purpose of the module.

x The intended learning outcomes should detail the knowledge, understanding and skills that students will be able to demonstrate on successful completion.

xi In some circumstances it may be necessary to have more than 5 intended learning outcomes. You will be asked to provide your rationale for this in discussion at the USP.

xii For example, if the assessment is an essay and the essay meets ILOs number 1-4 and 6-7, state 1-4,6-7

xiii If Method B is used for module mark calculation, indicate Yes to specify the assessment component(s) to be passed in order to pass the module

[xiv] Please specify component(s) for which ethical approval is required.

[xv] The “Indicative texts and/or learning materials/resources” box should include a maximum of five items for new modules. These should be formatted using the University’s agreed referencing style for the subject area (usually APA Harvard System 6th). See http://www.salford.ac.uk/library/infolit/tool#referencing_tab for more information. The texts should normally be recent texts (i.e. within the last six years) unless they are a particularly “classic” text. For existing modules, the “Indicative texts and/or learning materials/resources” box should include a link for USP reviewers and readers to the comprehensive reading list at http://lasu.salford.ac.uk