University of Cape Town

DEPARTMENT OF
PHYSICS

— 2018 —

Honours in Physics

PHY4000W

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University of Cape Town
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Contents

1 General information

The Department of Physics at the University of Cape Town (UCT) offers a one-year BSc Honours degree course with the course code

PHY4000W: BSc (HONS) in PHYSICS.

This course is usually taken by a student in the fourth year of university study, after having graduated with a BSc in Physics. The BSc Honours degree is the gateway towards further postgraduate degrees in Physics, such as the MSc and PhD degrees.

The course convener is Prof A. Peshier, **Andre.Peshier@uct.ac.za**; the external examiner is Dr H. Kriel (University of Stellenbosch).

The first meeting of class is on 9 February 2018, at 9:00, in room 508 in the RW James building.

1.1 Structure of the course

The Physics Honours course consists of 12 units, namely a supervised Research Project counting 3 units, and 9 'lecture' modules, each worth 1 unit. These lecture modules have typically 20 lectures as well as reading assignments, tutorial sessions and/or problem sets, or equivalent. They are categorized as:

- *Compulsory Physics* modules (5 modules)
- *Physics elective* modules (choose at least 2 modules)
- *Additional elective* modules (to bring the total number up to 9)

Research Project and Compulsory Physics modules contribute 8 out of the 12 units for the course. This obligatory part is to be complemented by at least 2 Physics elective modules and, in case, the appropriate number of Additional elective modules (offered by other departments). The latter must contain Physics related content, and are to be endorsed by the course convener and the

Head of Department. In exceptional circumstances, students may take one or two extra modules, see **Section 1.8**. The modules expected to be offered[1] are listed in **Table 1**.

The Honours course will kick off with activities to refresh mathematics skills, combined with a Mathematica and (V)Python introduction/recap, and discussions on the nature of physics and physics education. This 'Kick-off' module does not count as a unit, but it is compulsory for meeting the DP criteria (see **Section 1.6**).

1.2 Admission criteria

Admission to the Physics Honours course is at the discretion of the Dean of Science and the Head of Department of Physics, who will consult the Honours course convenor. Normally the following criteria are used:

- a pass mark of $\geq 60\%$ in UCT third year Physics courses, or equivalent, and
- a mathematical background strong enough to ensure success in the course, which requires a second year UCT Mathematics or Applied Mathematics course or equivalent. For a Theoretical/Mathematical Physics oriented choice of modules, a pass mark of $\geq 60\%$ in a third year UCT Mathematics or Applied Mathematics course, or equivalent.

In exceptional cases a student who does not meet the above criteria may be set reading and study material, and, upon satisfying the Head of Department that they have mastered this material, may be admitted.

[1] The Physics Department reserves the right to delete Physics modules, or add modules, or modify the list should staffing or other factors so dictate; for updates see the course website **www.phy.uct.ac.za/phy/courses/PHY4000W**.

	modules	semester	units
Compulsory	Kick-Off module (KO)	1	–
	Research Project (RP)	1+2	3
	Electrodynamics (ED_1 + ED_2)	1	2
	Quantum Mechanics (QM_1 + QM_2)	1	2
	Statistical Physics (SP)	2	1
Physics elective	Classical Mechanics (CM)	1	1
	Computational Physics (CP)	1	1
	Nuclear Physics (NP)	2	1
	Physics Education (PE)	1+2	1
	Particle Physics (PP)	2	1
	Quantum field theory (QF)	2	1
	Relativistic Q-Mechanics (RQ)	2	1
	Solid State Physics (SS)	2	1
Additional elective	Advanced Math Methods 1+2 [MAM]	1+2	1+1
	General Relativity [MAM]	1	1
	Programming for Scientists/Engineers [CERECAM]	1	1
	Continuum Mechanics [CERECAM]	1	1
	General Astrophysics [AST]	1	1
	Diagnostic Radiology [Med PHY]	1+2	1
	Radiotherapy [Med PHY]	1+2	1
	Nuclear Medicine [Med PHY]	1	1
	...	.	.

Table 1: The modules expected to be offered. Outlines of the Compulsory and the Physics elective modules are given in **Section 2.1**, see **Chapter 3** for the time table. The listed Additional elective modules are a subset of options available in previous years, see also **Section 2.2**.

1.3 Standard of the course and workload

The Physics Honours course is intensive. Coming after a three year general BSc degree, where a student has majored in two, and sometimes only one, subject, the Honours degree prepares a student for

- beginning a research MSc degree by dissertation
- doing well in the GRE examination for US graduate school
- entry into European or US post-graduate degree, if the student has done exceptionally well.

The content of the Physics Honours course is similar that of senior undergraduate courses in good European or US universities.

A rough estimate of the workload for one typical lecture module is

20 lectures (incl. question time)	20 hours
reading before and after lecture	20 hours
5 problem sets/tutorials	20 hours
independent study	20 hours
total	**80 hours**

Accordingly, a course of the requested 12 units would take about 960 hours. Divided by 120 days (24 weeks in academic term) this equates to 8 hours a day. The actual workload, including the research project, and including preparation for examinations, will depend on student preparedness and ability, and may well be 20 percent higher than this, and will fluctuate throughout the year.

1.4 Module choice

The broad content of a module is decided between the Head of Department, who bears ultimate responsibility for the academic content of the course and the modules, the Honours convenor, and the lecturer concerned.

A student must declare a provisional choice of modules at the first meeting of class. He or she can modify this choice by 5 pm on the Friday at the end of the first lecture week. A student can thereafter change the module choice (pickup, drop, change) only if the Head of Department, after consultation with the Honours convenor, agrees.

1.5 Research project

Research projects must, in opinion of the Head of Department (after consultation with the Honours convenor, senior colleagues and the project supervisor), be aligned with the academic nature of the course, i. e. experimental physics, or theoretical physics, or mathematical physics. The Head of Department will decide if each proposed research project (title, supervisor, description of nature of research project) is acceptable. Available projects are described on the course website **www.phy.uct.ac.za/phy/courses/PHY4000W**.

A project has to be chosen by the end of the second lecture week. A short progress report (1/2 – 1 page) is to be submitted one week before the last day of lectures of the first semester. If the Head of Department, after consultation with the Honours convenor, feels there has not been sufficient progress, a letter will be sent to the student and the supervisor, warning that the course DP certificate (see **Section 1.6**) may be withheld. At the beginning of the second semester an informal 10'-presentation is to be given on the work done so far.

The final project report, typically 30+ pages,[2] is to be submitted by a date set by the Head of Department and the Honours convenor (normally one week before lectures end); otherwise the DP certificate will be withheld. This report has a weight of 80% towards the project mark. Assessed by the supervisor, a referee, the Honours convenor and the Head of Department are the student's ability to conduct (supervised) research, including literature review, performing necessary calculations and/or experimental work, analysis of results as well as their presentation and discussion. Around the report submission date, a short presentation of the research project is to be given, which will be assessed by the supervisor, the referee, the Course convenor and the Head of Department, and which will contribute to the project mark with a weight of 20%.

[2] Theses from previous years are available in the WE Frahn library.

1.6 Duly performed (DP) certificate

Only students who receive a duly performed (DP) certificate, normally issued in the last week of lectures, will be allowed to write the October/November examinations. The DP certificate criteria are:

- a class record of at least 30% for all problem sets and class tests
- convincing progress in the Research Project, in particular the report being submitted
- attendance of *i*) the 'Kick-Off' module and *ii*) at least two thirds of the Wednesday Departmental colloquia.

1.7 Examinations

The 1st and 2nd semester modules will be examined in the respective examination period. Exceptionally, by agreement with students and lecturing staff, the Head of Department may direct examinations to take place outside these periods.

Student have to confirm the modules to sit for examination by the beginning of the 3rd last week of lectures or a date set by the Head of Department.

Results of the examination of all these modules will be used in a final aggregation by the Honours examination committee, a body whose membership is decided by the Head of Department and will typically include the Head of Department, the Honours convenor, lecturers, project supervisors and project readers as well as the external examiner(s). This Honours examination committee is advisory to the Head of Department, who submits results to the Science Faculty Examination Committee (FEC) for decision, and ultimate ratification by the University Senate.

1.8 Aggregation of marks

Passing PHY4000W requires marks of at least 50% for the coursework component (averaged over the lecture modules) and at least 50% for the project.

The final course mark is the mean of the individual module marks, unless the Head of Department shows good cause, in writing, for deviating from this.

In this average, the Research Project has a triple weight compared to the lecture modules (each worth one unit). For a module choice with more than the minimum number of 9 lecture modules, the results of the 5 Compulsory modules, the 2 best Physics-elective modules and the 2 best of the remaining modules enter the average.

The pass/fail decision is based on this final mark exceeding the pass mark of **50%**, and is further subject to the **subminimum criteria** of

- passing six of the lecture modules used to determine the final grade
- achieving a mark of $\geq$ 35% in all but two of the Compulsory lecture modules.

A student who fails the Honours course may not be re-admitted.

1.9 Resources

The Department has a **Postgraduate Computer Lab** on Level 4 of the RW James Building which is open to Physics Honours students. The 8 Quad-Core+GPU PCs run both Windows and Linux; available software includes LaTeX, Open/MS Office, Mathematica and V/Python. A printing facility is available (printing abuse would be detected). Details of Lab and Computer usage can be found on posters located around the Lab. For further information contact the Lab administrator Kerwin Ontong, **Kerwin.Ontong@uct.ac.za**.

The Honours students have access to the **WE Frahn library** on Level 5 of the **RW James Building**, which provides also quiet working space. Contact Gregor Leigh, **Gregor.Leigh@uct.ac.za**, for further details.

A general guide to new Postgrad students is available on the department website **www.phy.uct.ac.za**.

Last but not least: the **Duncan Elliott room** on Level 3 of the RW James Building is a place to meet other Postgrad students and members of staff, to discuss Physics and more ... and, of course, to have a cup of tea or coffee after the third lecture period and/or in the afternoon.

2 Description of Modules

2.1 Compulsory and Physics elective Modules

2.1.1 Classical Mechanics (CM)

Lecturer	Em. A/Prof R. Fearick, **Roger.Fearick@uct.ac.za**
20 Lectures	***First semester***
5 Tutorials	counting 25% towards module mark
Class Test	counting 25% towards module mark
Exam	2 hours, in June/July, counting 50% towards module mark

Classical mechanics is the basis for all further developments in physics. While the Newtonian formulation seems simple enough, the Lagrange and Hamilton formulations reveal a deep connection with modern ideas of geometry and the mathematics of differentiable manifolds. This course introduces you to these ideas.

Outline

Newtonian mechanics: space and time, Newton's laws, systems with one degree of freedom, central forces, non-inertial frames — *Lagrange formalism:* the route to Lagrange's equations, calculus of variations, Hamilton's principle of least action, conserved quantities, transformations of the Lagrangian — *Hamilton formalism:* the Hamiltonian, phase space, Poisson brackets, canonical transformations — *Advanced topics:* approximate methods, rigid bodies.

Literature

[1] F. Scheck, *Mechanics: From Newton's laws to deterministic chaos*, Springer 2005.

[2] J. V. Jose and E. J. Saletan, *Classical Dynamics: A Contemporary Approach*, Cambridge 1998.

2.1.2 Computational Physics (CP)

Lecturer	Dr T. Dietel, **Thomas.Dietel@uct.ac.za**
20 Lectures	***First semester***
5 Tutorials	counting 25% towards module mark
Test	Take-home, counting 25% towards module mark
Exam	Take-home, in June/July, counting 50% towards module mark

Students are expected to be familiar with at least one programming language.

Outline

In the real world, very few deterministic problems can be solved analytically. Furthermore, many physical processes are stochastic. In both cases, physicists look to computers to shed light on the physics. In this module, several of the more ubiquitous numerical methods will be introduced that form part of most physicists' toolkits.

Monte Carlo techniques of sampling, integration and simulation — Numerical calculus (including integration using orthogonal polynomials) — Function interpolation, extrapolation and fitting — ODE and PDE solution.

Literature

[1] R. de Vries, *A first course in computational physics*, Wiley 1994.

[2] A. L. Garcia, *Numerical methods for physics*, Prentice-Hall 1994.

[3] N. J. Giordano, *Computational Physics*, Prentice-Hall 1997.

[4] T. Pang, *An introduction to computational physics*, Cambridge 2006.

[5] W. H. Press et al., *Numerical recipes*, Cambridge (various editions for different programming languages).

2.1.3 Electrodynamics 1 (ED_1)

Lecturer	A/Prof H. Weigert, **Heribert.Weigert@uct.ac.za**
20 lectures	***First semester, first quarter***
5 tutorials	counting 25% towards module mark
Class test	counting 25% towards module mark
Exam	2 hours, in June/July, counting 50% towards module mark

Outline

History and perspective — introduction to vector calculus — basic principles of electrostatics — solving differential equations: Green's functions, boundary conditions, complete sets of states — electrostatics in media — magneto-statics — magneto-statics in media — electrodynamics and Maxwell's equations.

Literature

[1] J. D. Jackson, *Classical Electrodynamics*, Wiley 1980.

[2] A. Zangwill, *Modern electrodynamics*, Cambridge University Press 2013.

[3] L. D. Landau and E. M. Lifshitz, *Vol. 2: The Classical Theory of Fields*, Butterworth-Heinemann 1980.

[4] L. D. Landau and E. M. Lifshitz, *Vol. 8: Electrodynamics of Continuous Media*, Butterworth-Heinemann 1984.

2.1.4 Electrodynamics 2 (ED_2)

Lecturer	A/Prof H. Weigert, **Heribert.Weigert@uct.ac.za**
20 lectures	***First semester, second quarter***
5 tutorials	counting 25% towards module mark
Class Test	counting 25% towards module mark
Exam	2 hours, in June/July, counting 50% towards module mark

Outline

Relativistically covariant formulation of electrodynamics — gauge potentials and a count of degrees of freedom — electrodynamics as a classical field theory

— Greens functions revisited: Fourier transforms and the use of residues — moving charges and radiation — multipole expansions and spherical harmonics — electromagnetic waves in vacuum and in media — from electromagnetism to ray optics and beyond.

Literature

Same as for module ED_1.

2.1.5 Kick-off module (KO)

Activities in the orientation week involving several lecturers and dealing with:

- the nature of physics and physics education,
- mathematical tools and skills for the Honours course, combined with an introduction to Mathematica, and a Python/VPython refresher,

largely discussion and tutorial-based, with hands-on activities, team work as well as homework. No grades, but required for the DP certificate.

Outline

Intro to philosophy and nature of physics; Role of mathematics and modelling; Why is physics hard to learn? (A perspective from cognitive psychology); role of practical work in learning physics; Learning to think computationally. — Introduction to Mathematica; linear algebra and vector calculus; complex analysis; differential equations; Fourier analysis and integral transforms; numerical methods.

2.1.6 Nuclear Physics (NP)

Lecturer	Dr T. Leadbeater, **Tom.Leadbeater@uct.ac.za**
20 lectures	***Second semester***
problem sets	counting 20% towards module mark
practicals	counting 30% towards module mark
Exam	in November, counting 50% towards module mark

Outline

This module will feature the practical aspects of nuclear physics, in particular detection and measurement of particle and gamma radiation. Topics will include the basic nuclear processes in radioactive sources, the production of particle radiation beams, particle accelerators, the passage of radiation through matter, radiation protection, the general characteristics of detectors, ionization detectors, scintillation detectors, semiconductor detectors, the statistical treatment of radiation measurements, methods of pulse analysis, spectral analyses, nuclear electronics, digital pulse processing, applications in nuclear and particle physics. The module includes five practical exercises associated with radiation detector design and application.

Literature

[1] G. F. Knoll, *Radiation Detection and Measurement*, Wiley 2010.

[2] W. R. Leo, *Techniques for Nuclear and Particle Physics Experiments*, Springer 1994

2.1.7 Physics Education (PE)

Lecturer	A/Prof S. Allie, **Saalih.Allie@uct.ac.za**
20 lectures	seminar style format, ***First and second semester***
2 essays/projects	counting 50% towards module mark
Exam	Take-home: 2 essays, in November, counting 50% towards module mark

Outline

While most of physics involves learning various content areas such as nuclear, particle, solid state etc., physics education deals with how *we learn physics. Although physics education has a long history the area called Physics Education Research (PER) is a more recent addition to the sub-disciplines of physics. For example, since 2005 there is a journal dedicated to PER within the influential Physical Review series, namely Physical Review Special Topics Physics Education Research (PRSTPER). Several North American universities now advertise posts for lecturers in physics departments who have completed PhDs in PER. It is also interesting to note that other disciplines such as Chemistry and more recently Biology are also following this model. This* *discipline focussed approach to researching educational issues in science disciplines is referred to as (Science) Discipline Based Education Research (DBER).*

The module is aimed as an introduction to the area of PE and PER with a particular focus on issues pertaining to the teaching and learning of physics at university level. The list below indicates the main themes that will form the basis of the course. Since the themes are inter-linked the order of presentation is not linear but should rather be thought of as 'topic hubs' in a network.

What is Physics? — Exploring the 'nature' of student difficulties — Issues in cognitive science that could inform understanding the learning physics — Teaching physics — Physics Education Research.

Literature will be provided.

2.1.8 Particle Physics (PP)

Lecturer	Dr S. Yacoob, **Sahal.Yacoob@uct.ac.za**
20 lectures	***Second semester***
5 tutorials	counting 25% towards module mark
1 oral presentation	counting 10% towards module mark
Class test	counting 15% towards module mark
Exam	2 hours, in November, counting 50% towards module mark

Outline

Classification of elementary particles, introduction to experimental techniques in particle physics, particle decays, cross sections, Dirac equation, Feynman calculus, elastic scattering, deep inelastic scattering and the quark model, symmetries, gauge theories (QED, Electroweak theory, QCD), neutrino oscillations, CP violation, the Standard Model.

Literature

[1] M. Thomson, *Modern Particle Physics*, Cambridge 2013.

[2] D. Griffiths, *Introduction to Elementary Particle Physics*, Wiley 2005.

2.1.9 Quantum Field Theory (QF)

NB: *module can only be taken in conjunction with Rel. Quantum Mechanics*

Lecturer	Dr W. A. Horowitz, **WA.Horowitz@uct.ac.za**
10 lectures + self study (equivalent to 20 lectures)	***Second semester, 4th quarter***
tutorials	counting 50% towards module mark
1 project	counting 50% towards module mark

Outline

Quantizing gauge fields — Fadeev-Popov gauge fixing — Non-abelian fields — Tree level calculations — Renormalization.

Literature

[1] M. E. Peskin and D. V. Schroeder, *An introduction to Quantum Field Theory*, Addison Wesley 1995.

[2] G. Sterman, *An Introduction to Quantum Field Theory*, Cambridge 1993.

[3] L. H. Ryder, *Quantum Field Theory*, Cambridge 1996.

[4] M. Srednicki, *Quantum Field Theory*, Cambridge 2007.

2.1.10 Quantum Mechanics 1 (QM_1)

Lecturer	Prof A. Peshier, **Andre.Peshier@uct.ac.za**
20 lectures	***First semester, first quarter***
5 tutorials	counting 25% towards module mark
Class test	counting 25% towards module mark
Exam	2 hours, in June/July, counting 50% towards module mark

Outline

Some historical remarks — *Postulates and concepts of Quantum Mechanics*: vectors and operators in Hilbert space and their representation; observables, measurements and uncertainties — *Quantum evolution*: Schrödinger equation, Schrödinger vs. Heisenberg picture, harmonic oscillator, path integrals

— *Angular momentum*: rotations and commutation relations, spin and angular momentum eigenstates and eigenvalues, addition of angular momenta, spin correlations and Bell's inequality.

Literature

[1] J. J. Sakurai, *Modern Quantum Mechanics*, Addison Wesley 1993.

[2] L. D. Landau and E. M. Lifshitz, *Vol. 3: Quantum Mechanics*, Butterworth-Heinemann 1981.

[3] A. Messiah, *Quantum Mechanics*, Dover 1999.

[4] R. P. Feynman and A. R. Hibbs, *Quantum Mechanics and Path Integrals*, Dover 2010.

2.1.11 Quantum Mechanics 2 (QM_2)

Lecturer	Prof A. Peshier, **Andre.Peshier@uct.ac.za**
20 lectures	***First semester, second quarter***
5 tutorials	counting 25% towards module mark
Class test	counting 25% towards module mark
Exam	2 hours, in June/July, counting 50% towards module mark

Outline

Many-particle quantum systems: exchange symmetry, Pauli exclusion principle, spin-statistics theorem — *Approximation methods:* time-independent perturbation theory, Fermi's golden rule, variational methods, WKB approximation — *Scattering theory:* Lippman-Schwinger equation, Born approximation, Optical theorem.

Literature

Same as for QM_1.

2.1.12 Relativistic Quantum Mechanics (RQ)

Lecturer	Dr W. A. Horowitz, **WA.Horowitz@uct.ac.za**
20 lectures	***Second semester, 3rd quarter***
5 tutorials	counting 50% towards module mark
Exam	2 hours, in November, counting 50% towards module mark

Outline

Relativistic invariance, equations and Lagrange densities for Klein-Gordon and Dirac and vector fields — Elements of a quantum theory of fields: scalar, vector and spinor fields — Particle interactions, simple Feynman diagrams and scattering matrix; cross sections and decay rates; phase space.

Literature

[1] M. E. Peskin and D. V. Schroeder, *An introduction to Quantum Field Theory*, Addison Wesley 1995.

[2] G. Sterman, *An Introduction to Quantum Field Theory*, Cambridge 1993.

[3] C. Itzykson and J.-B. Zuber, *Quantum Field Theory*, McGraw Hill 1980.

[4] M. D. Schwartz, *Quantum Field Theory and the Standard Model*, Cambridge 2014.

[5] L. H. Ryder, *Quantum Field Theory*, Cambridge 1996.

[6] M. Srednicki, *Quantum Field Theory*, Cambridge 2007.

[7] L. S. Brown, *Quantum Field Theory*, Cambridge 1994.

[8] J. D. Bjorken and S. D. Drell, *Relativistic Quantum Mechanics*, McGraw Hill 1963.

2.1.13 Statistical Physics (SP)

Lecturer	Em. Prof J. Cleymans, **Jean.Cleymans@uct.ac.za**
20 lectures	***Second semester***
5 tutorials	counting 25% towards module mark
Class test	counting 25% towards module mark
Exam	2 hours, in November, counting 50% towards module mark

Outline

Applications of equilibrium thermodynamics; Speed of sound in an ideal gas; Gravitational pressure, white dwarfs — Applications of statistical mechanics; Paramagnetism; Ising model, Einstein model, Debye model, phonons — Kinetic theory: Boltzmann equation, Collision term.

Literature

[1] D. V. Schroeder, *An introduction to Thermal Physics*, Pearson 1999.

[2] J. Cleymans, *Statistical Mechanics II: Applications*, draft.

2.1.14 Solid State Physics (SS)

NB: *module will only be offered if sufficiently many students enroll*

Lecturer	A/Prof M. Blumenthal, **Mark.Blumenthal@uct.ac.za**
20 Lectures	***Second semester***
5 tutorials	counting 25% towards module mark
2 paper reviews	counting 10% towards module mark
Class test	counting 15% towards module mark
Exam	2 hours, in November, counting 50% towards module mark

Outline

Review of Bulk Semiconductors: Crystal structure, energy band structure, doping — *Introduction to Low Dimensional Systems*: Length and energy scales, overview of fabrication techniques and possibilities in nano-physics, applications of low-dimensional physics — *Electron Properties in Low Dimensional Systems*:

Band engineering, heterostructures, free electron gas, 2D electron gas, 1D electron gas, 0D electron gas, density of states — *Quantum Transport*: 1D wires, 0D quantum dots, Coulomb blockade, resonant tunnelling, charge detection, single-electron dots, electron pumps and turnstiles, surface-acoustic-wave current source — *Electrons in magnetic fields*: Landau levels, Shubnikov-De Haas effect, integer quantum Hall effect, edge states, Aharonov-Bohm effect.

Literature

[1] C. Kittel, *Introduction to Solid State Physics*, Wiley 1996.

[2] N. W. Aschcroft and N. D. Mermin, *Solid State Physics*, Holt, Rinehard and Winston 1976.

[3] M. J. Kelly, *Low-dimensional Semiconductors: Materials, Physics, Technology, Devices*, Clarendon Press 1996.

[4] J. H. Davies, *The Physics of Low-Dimensional Semiconductors: An introduction*, Cambridge 1997.

[5] E. L. Wolf, *Nanophysics and Nanotechnology*, Wiley 2007.

2.2 Additional elective Modules

Other departments, e. g. Applied Mathematics or Medical Physics, usually offer some courses/modules with appropriate overlap to physics, see **Table 1**, which could be selected as Additional elective modules. Consult the course coordinator, who has to endorse the choice with the Head of Department.

2.3 Research Projects

Check the course website **www.phy.uct.ac.za/phy/courses/PHY4000W** for the list of offered projects, which reflect the spectrum of research activities of the department, see **www.phy.uct.ac.za/phy/research**.

3 Lecture time table

The time tables below are drafts and might be changed to avoid clashes with modules from other departments. For updates as well as a detailed course calendar, please check the **course website**.

All Physics courses will be given in the RW James Building.

First semester

period		Mon	Tue	Wed	Thu	Fri
1	08:00 - 08:45					
2	09:00 - 09:45	CM	CP	tut CM/CP	CM	CP
3	10:00 - 10:45	QM	QM	QM	QM	tut QM
4	11:00 - 11:45	tut ED	ED	ED	ED	ED
5	12:00-12:45			colloq		

CM=Classical Mechanics
CP=Computational Physics
ED=Electrodynamics 1+2
QM=Quantum Mechanics 1+2

The CM and CP tutorial sessions are biweekly, on alternating Wednesdays.

Second semester

period		Mon	Tue	Wed	Thu	Fri
1	08:00 - 08:45	RQ/QF	RQ/QF	RQ/QF	RQ/QF	tut RQ/QF
2	09:00 - 09:45					
3	10:00 - 10:45	NP	PP	tut NP/PP	NP	PP
4	11:00 - 11:45	tut SS/SP	SP	SS	SP	SS
5	12:00-12:45			colloq		

NP=Nuclear Physics
PP=Particle Physics
QF=Quantum Field Theory
RQ= Relativistic QM
SP=Statistical Physics
SS=Solid State Physics

The SS/SP and NP/PP tutorial sessions are biweekly, on alternating Mondays and Wednesdays, respectively. The RQ module runs in the first half of the semester (3rd quarter) with 4 lectures per week and one tutorial, the QF module follows in the second half of the semester (4th quarter).