School of Physics

Course Outline 2020

PHYS3117

Physics Laboratory

School of Physics

Faculty of Science

T3, 2020

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Peter Reece	p.reece@unsw.edu.au	Consultation times: by arrangement via email	(02) 9385 4998
Laboratory Manager	Tamara Reztsova	t.reztsova@unsw.edu.au	142D, OMB K15	(02) 9385 4577
Teaching Support Officer	Zofia Krawczyk-Bernotas	z.krawczyk-bernotas@unsw.edu.au	School of Physics office G06, Old Main Building	(02) 9385 5969

2. Course information

Prerequisites:

PHYS3112

Teaching times and locations: Students will be allocated one of the following four-hour lab sessions:

Tuesday 09:00-13:00 (Weeks 1-5, 7-10)

Tuesday 14:00-16:00 (Weeks 1-5, 7-10)

2.1 Course summary

This course provides students with the opportunity to conduct advanced experimental investigations in a range of areas including: Electromagnetism; Lasers and Spectroscopy; Optics and Photonics; Solid State Physics; Atomic Physics & Nuclear Physics. Some experiments will be performed in research laboratories, guided by researchers.

Graduate Attributes Developed in this Course:

- Research, inquiry and analytical thinking abilities
- Capability and motivation for intellectual development
- Ethical, social and professional understanding
- Communication in a scientific/technical context
- Collaborative and management skills
- Information literacy

2.3 Course learning outcomes (CLO)

By the end of this course, you will be able to:
1. Plan and conduct advanced experimental studies from a range of different sub-disciplines of physics using modern techniques and practices.
2. Survey literature and reference material relateing to the lab topic to gain a deeper insight into the signficiance of the experiments and the experimental results.
3. Perform analysis of experimental data and uncertainties and assess the validity of theoretical models applied to its interpreation.
4. Communicate research finding through written lab reports and formal presentation.

2.4 Relationship between course and program learning outcomes and assessments

The course learning outcomes 1-3 are assessed in the 3 assessment tasks. These assessments are largely of a critical-thinking nature designed to determine students' ability to deploy acquired knowledge to new situations, which is a key graduate attribute for successful university graduates.

3. Strategies and approaches to learning

3.1 Learning and teaching activities

Assumed Knowledge
Prerequisites: PHYS3112

Timetable

Lecture: 1 x 1hr (Week 1-3, 5, 7-10)
Laboratory 1x 4hr (Week 1-5, 7-10)

Lecture Timetable

Day Time Location
Monday (w1-3, 5, 7-10) 16:00-17:00 Online

Laboratory:

Tuesday (w 1-5, 7-10) 9:00-13:00 OMB142
Tuesday (w 1-5, 7-10) 14:00-18:00 OMB142

3.2 Expectations of students

We believe that effective learning is best supported by a climate of enquiry, in which students are actively engaged in the learning process. To ensure effective learning, students should participate in class. Effective learning is achieved when students attend all classes, have prepared effectively for classes by reading through previous lecture notes, in the case of lectures, and, in the case of tutorials or laboratories, have made a serious attempt at doing the problems or pre-work themselves prior to the class. Furthermore, lectures should be viewed by the student as an opportunity to learn, rather than just copy down lecture notes. Effective learning is achieved when students have a genuine interest in the subject and make a serious effort to master the basic material.

Academic misconduct will not be tolerated in any form in this course. Substantiated instances of cheating, plagiarism or copying answers may result in a failure grade or significant deduction of marks. Please https://student.unsw.edu.au/plagiarism if you are in any way unsure of what constitutes plagiarism. Assignments in this class are to be done independently.

4. Course schedule and structure

Detailed Syllabus
Students will choose experiments from the following list; the estimated duration of each experiment is indicated in the table. Abridged versions of experiments that have been completed as part of a previous course cannot chosen for this elective. Experiments have been grouped in subject streams, however experiments may be chosen from any stream.

Stream 1: Physical Optics and Optical Fibres		**Units**
1.1	Polarization of Light (POL)	8
1.2	Fourier Optics (FO)	8
1.3	Optical Fibres (OF)	8
1.4	Optical Fibre Sensors (OFS)	8
1.5	Optical Time Domain Reflectometry (ODTR)	4
1.6	Holography (HOL)	8
1.proj	Adaptive Optics	8
Stream 2: Lasers and Spectroscopy		
2.1	Properties of Laser Light (PLL)	8
2.2	Acousto-Optics (AO)	8
2.3	Photodetector and Light Source Characteristics (PDC)	8
2.4	Injection Diode Lasers (ILD)	8
2.5	Diode Pumped Solid State Laser (DPSS)	8
2.proj.	Saturation Absorption Spectroscopy	8
Stream 3: Nuclear and Radiation Physics		
3.1	Radiation Fundamentals (RF)	8
3.2	Neutron Irradiation (NI)	8
3.3	Gamma Ray Spectroscopy (GRS)	8
3.4	Coincidence Counting (CC)	12
3.proj	X-ray Computed Tomography	8
Stream 4: Solid State Physics		
4.1	Magnetic Transitions (MT)	8
4.2	Scanning Electron Microscopy (SEM)	8
4.3	Advanced X-Ray Diffraction (AXRD)	4
4.4	Superconducting Quantum Interference Devices (SQUID)	4
4.proj	Surface Acoustic Wave Devices (SAW)	8
Stream 5: Atomic Physics		
5.1	CW Nuclear Magnetic Resonance (NMR)	4

5.2	Pulsed NMR (PNMR)	8
5.3	Normal Zeeman Effect (NZE)	8
5.proj	Magneto-Optical Trap (MOT)	8
Stream 6: Mechanics / Statistical Mechanics		
6.1	Chaotic Pendulum	12

Laboratory information

Experimental notes and resource information will be made available on the Moodle website.

Lecture information

Each week there will be a lecture discussing practical aspects of working as a professional experimental physicist. These will include an introduction to specific physical teachniques that are commonly found in a physics research laboratories; analysis tools and techniques; and professional activities such as, collaboration, commercialisation and research funding. Topics from the following list will be covered:

- Introduction to the lab and subject overview. General aspects of lab safety; laser safety; safety during the time of COVID 19.
- Data fitting – linear and nonlinear fits with error analysis
- Vacuum systems
- Cryogenic systems
- Electrical measurements
- Optical measurements
- Nuclear and radiation physics
- Intellectual Property and Commercialisation
- Fraud and misconduct in physics

5. Assessment

5.1 Assessment tasks

Assessment

Assessment task	Length	Weight	Mark	Due date *(normally midnight on due date)*
Laser Safety Assignment		5%		Week 4
Presentation Assessment		5%		Week 10
Laboratory		90%		

Students will complete a number of experiments chosen from the list above. **The total number of units to be completed over the course of the semester is 32.** The units indicate the length and complexity of the experiments. Experiments have been grouped into subject streams, however

experiments may be chosen from any stream. In addition, project-based experiments are available for high-performing students.

Assessments will be based on a written lab report and interview with the course coordinator. Marks will be allocated based (i) an understanding of the principles, (ii) the quality of the experimental results and analysis, and (iii) the presentation of the written report. There will be two additional assessments for the course – a laser safety assignment and a presentation. Further details will be provided.

Further information

UNSW grading system: student.unsw.edu.au/grades

UNSW assessment policy: student.unsw.edu.au/assessment5.2

Assessment criteria and standards

Please see Moodle for a marking rubric for each assessment task.

5.3 Submission of assessment tasks

Assignment Submissions
Unless otherwise specified, assignments should be submitted online by 5pm on the due date.

A downloadable assignment cover sheet is available from
https://www.physics.unsw.edu.au/current-students/cover-sheet

Marks will be deducted for late assignments, at a rate of 5% of the maximum possible mark for the assignment per day. A weekend will count as two days. An assignment submitted after the solutions have been posted will automatically receive 0%.

5.4. Feedback on assessment

Please see Moodle for details on how feedback will be provided for each assessment task

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

1 International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

- The *Current Students* site student.unsw.edu.au/plagiarism, and
- The *ELISE* training site subjectguides.library.unsw.edu.au/elise

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: student.unsw.edu.au/conduct.

7. Readings and resources

Prescribed Text:
None

Other Resources
Lecture notes will be posted on Moodle

8. Administrative matters

Communications

Students should check their UNSW email account regularly as all official university communication will be sent to that address. Students should use their university email account when writing to UNSW staff and should always include their name and student number.

Health and Safety

The School of Physics is actively committed to the health, safety and welfare of its staff and students. Information on relevant UNSW Occupational Health and Safety policies and expectations is available at: www.ohs.unsw.edu.au and https://www.physics.unsw.edu.au/about/safety

Recommended Internet Sites

The School of Physics website is www.physics.unsw.edu.au. Under the "Current Students" link students will find information about degrees, courses, and assessment.

The University website my.unsw.edu.au provides links to the UNSW Handbook, Timetables, Calendars and other student information.

Student Complaint Procedures

UNSW has procedures for dealing with complaints. These aim to solve grievances as quickly and as close to the source as possible. Information is available here: student.unsw.edu.au/complaints. Staff who can assist include:

School Contacts:

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9. Additional support for students

- The *Current Students* Gateway: student.unsw.edu.au
- Academic Skills and Support: student.unsw.edu.au/skills
- Student Wellbeing, Health and Safety: student.unsw.edu.au/wellbeing
- Disability Support Services: student.unsw.edu.au/disability
- UNSW IT Service Centre: www.it.unsw.edu.au/students