UNSW Course Outline

PHYS3117 Physics Laboratory - 2024

Published on the 25 Aug 2024

General Course Information

Course Code : PHYS3117
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Physics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course provides students with an opportunity to conduct a series of advanced experimental investigations in a range of areas, including: Electronics; Electromagnetism; Laser and Spectroscopy; Optics and Photonics; Quantum, Atomic and Nuclear Physics; Solid State Physics;

and Nanotechnology. Experiments consist of a series of self-directed exercises that make use of specific sets of instruments/apparatus, and are run over a number of weekly four-hour laboratory sessions within the Higher Year Teaching Laboratory. In addition to the standard laboratory experiments, students will conduct a take-home project throughout the term focused on chaotic/ complex dynamics. The project work is supported by a weekly lecture, which introduces the concepts and techniques necessary to complete the project. Laboratory and project work is assessed through a written report together with a 20-minute oral interview with the academic coordinator.

Course Aims

The aim of this course is to provide students with hands-on experience in the conduction of advanced physics experiments. The incorporation of modern experimental techniques and equipment will provide practical skills that are directly applicable to research and industry. A strong focus on quantitative analysis is used to understand the implications of theoretical concepts in a practical setting.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply advanced laboratory techniques to investigate physical phenomena in different experimental contexts.
CLO2 : Use quantitative analysis to evaluate experimental data and compare results with those expected from supporting theory and prior works.
CLO3 : Communicate experimental findings concisely, through both oral and written presentation, in a way that summarizes the key findings, highlights the significances of the results and identifies the limitation of any approach taken.
CLO4 : Critique previously published work and relate it to your own experimental investigations to justify conclusions about the results.
CLO5 : Devise and implement your own experimental plan to investigate physics related phenomena and use the finding to evaluate your approach.

Course Learning Outcomes	Assessment Item
CLO1 : Apply advanced laboratory techniques to investigate physical phenomena in different experimental contexts.	• Chaotic Circuit Project • Laboratory
CLO2 : Use quantitative analysis to evaluate experimental data and compare results with those expected from supporting theory and prior works.	• Chaotic Circuit Project • Laboratory
CLO3 : Communicate experimental findings concisely, through both oral and written presentation, in a way that summarizes the key findings, highlights the significances of the results and identifies the limitation of any approach taken.	• Journal Club Presentation • Chaotic Circuit Project • Laboratory
CLO4 : Critique previously published work and relate it to your own experimental investigations to justify conclusions about the results.	• Journal Club Presentation • Chaotic Circuit Project • Laboratory
CLO5 : Devise and implement your own experimental plan to investigate physics related phenomena and use the finding to evaluate your approach.	• Chaotic Circuit Project • Laboratory

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Chaotic Circuit Project Assessment Format: Individual Short Extension: Yes (3 days)	20%	Start Date: Not Applicable Due Date: Not Applicable
Laboratory Assessment Format: Individual Short Extension: Yes (3 days)	70%	Start Date: Not Applicable Due Date: Not Applicable
Journal Club Presentation Assessment Format: Individual Short Extension: Yes (3 days)	10%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Chaotic Circuit Project

Assessment Overview

For this assessment you will be conducting a take-home experiment throughout the term focused on chaotic/complex dynamics. Your task will be to construct a chaotic circuit using supplied electronic components, perform a parametric analysis of the circuit using supplied data acquisition tools and analyse the results in terms of simple coupled nonlinear differential equations. The aim of the task is to demonstrate that the circuit exhibits chaos and that the behaviour is consistent with what is expected from theory. Assistance is provided each week during the lectures and labs on how to build, interface with and simulate the circuit. You will be assessed based on a written lab report and interview with an academic marker in week 10. Marks will be allocated based on (i) an understanding of the principles, (ii) the quality of the experimental results and analysis, and (iii) the presentation of the written report.

Course Learning Outcomes

- CLO1 : Apply advanced laboratory techniques to investigate physical phenomena in different experimental contexts.
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- CLO3 : Communicate experimental findings concisely, through both oral and written presentation, in a way that summarizes the key findings, highlights the significances of the results and identifies the limitation of any approach taken.
- CLO4 : Critique previously published work and relate it to your own experimental investigations to justify conclusions about the results.
- CLO5 : Devise and implement your own experimental plan to investigate physics related

phenomena and use the finding to evaluate your approach.

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Laboratory

Assessment Overview

You will complete several experiments throughout the term, chosen from a set list, varying in both expected completion time and response length (e.g. experiments which are more complex take longer and have longer reports, but you complete fewer in the term). Students must select enough experiments to fill the length of the term. Experiments are organized into topics and are based on specific instrumentation available. Further details will be explained in the course materials.

The experiments consist of a series of interrelated tasks that build knowledge of the topics and related experimental techniques. There is an expectation that you will attend the laboratory each week at the assigned time to complete these tasks. Analysis of results obtained in the lab and a reflection of their meaning in the context of relevant theory is done outside of class.

You will be assessed based on a written lab report and interview with an academic marker the week after completing the task. The expected length of the report will vary between experiments. Marks will be allocated based on (i) an understanding of the principles, (ii) the quality of the experimental results and analysis, and (iii) the presentation of the written report.

Feedback will also be provided on how improvements can be made for subsequent experiments.

Course Learning Outcomes

- CLO1 : Apply advanced laboratory techniques to investigate physical phenomena in different

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Journal Club Presentation

Assessment Overview

With the aid of the journal database, Scopus (or others), you will identify and investigate an interesting / significant publication in an application area of chaotic dynamics and presenting your findings to the class. The journal club presentations are scheduled during the lecture class in Week 8 and 9. The aim here is to interpret the publication in terms of concepts you are familiar with from the chaotic circuit project and supplemented by your undergraduate physics knowledge. The assessment will take the form of a 10-minute presentation, followed by 5-minute discussion facilitated by the lecturer. You will be assessed on your ability to convey a concise summary of the work including its significance and novelty, and the underlying principles of complex dynamics. Marks are also included from participating meaningfully in a discussion of the paper. Presentations are marked against a rubric and written feedback is provided within the week.

Course Learning Outcomes

- CLO3 : Communicate experimental findings concisely, through both oral and written presentation, in a way that summarizes the key findings, highlights the significances of the results and identifies the limitation of any approach taken.
- CLO4 : Critique previously published work and relate it to your own experimental investigations to justify conclusions about the results.

Assignment submission Turnitin type

This is not a Turnitin assignment

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General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

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. 1.1 Polarization of Light (POL) 8

2. 1.2 Fourier Optics (FO) 8

3. 1.3 Optical Fibres (OF) 8

4. 1.4 Optical Fibre Sensors (OFS) 8

5. 1.5 Optical Time Domain Reflectometry (ODTR) 4

6. 1.6 Holography (HOL) 8

1.proj Adaptive Optics 8

Stream 2: Lasers and Spectroscopy

1. 2.1 Properties of Laser Light (PLL) 8

2. 2.2 Acousto-Optics (AO) 8

3. 2.3 Photodetector and Light Source Characteristics (PDC) 8

4. 2.4 Injection Diode Lasers (ILD) 8

5. 2.5 Diode Pumped Solid State Laser (DPSS) 8

2.proj. Saturation Absorption Spectroscopy 8

Stream 3: Nuclear and Radiation Physics

1. 3.1 Radiation Fundamentals (RF) 8

2. 3.2 Neutron Irradiation (NI) 8

3. 3.3 Gamma Ray Spectroscopy (GRS) 8

4. 3.4 Coincidence Counting (CC) 12

3.proj X-ray Computed Tomography 8

Stream 4: Solid State Physics

1. 4.1 Magnetic Transitions (MT) 8

2. 4.2 Scanning Electron Microscopy (SEM) 8

3. 4.3 Advanced X-Ray Diffraction (AXRD) 4

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

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

The lecture time on Monday will be used as a workshop and will focus on providing information that will assist on completing the take-home chaotic circuit project and the journal club presentation. An outline of the topics covered each week is included below.

W1

Introduction to the lab and subject overview. General aspects of lab safety; laser safety; safety during the time of COVID 19.

W2

Introduction to the chaotic pendulum as a model system for chaotic dynamics: use the chaotic pendulum experiment from the HYL as a demonstrator for chaotic motion. Introduce various concepts relevant to analysing chaotic motion, including, phase diagrams, bifurcation plots, Poincare sections, fractional dimensions, etc.

W3

Focus on modelling of the basic equations of motion to observe relevant features of chaotic motion. Review the Runge-Kutta technique for numerical integration of ordinary differential equations and apply to chaotic pendulum.

W4

Review the RLC circuit and Kirchhoff's laws for AC electrical circuit components in terms of an ODE. Introduce the operational amplifier and look at its function in electronic circuits (golden

rules etc.).

W5

Analyse the chaotic circuit, identify functional elements, and relate them to the terms in the governing nonlinear \ ODE. Describe main results expected for the circuit.

W6

Flexibility Week

W7

Assessment Interview for the Chaotic Circuit Project

W8

Introduction to the journal club, effective techniques for negotiating the literature and presenting your findings to your peers.

W9

Assessment Journal club presentation.

Course Resources

Prescribed Resources

None

Recommended Resources

Lecture notes will be posted on Moodle

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Clemens Ulrich					No	Yes
Lab staff	Tamara Reztsova					No	No
Administrator	Zofia Krawczyk					No	No
Director of teaching	Peter Reece					No	No
Year coordinator	Elizabeth Angstmann					No	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

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 https://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. 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, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

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

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines