

UNSW Course Outline

MTRN3500 Computing Applications in Mechatronics Systems - 2023

Published on the 07 Sep 2023

General Course Information

Course Code: MTRN3500

Year: 2023 Term: Term 3

Teaching Period: T3

Is a multi-term course?: No Faculty: Faculty of Engineering

Academic Unit: School of Mechanical and Manufacturing Engineering

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

The aim of this course is to implement software for vehicle simulation and control. The previously acquired C/C++ programming and control systems knowledge is used to develop user interfaces, simulations models and control algorithms for the control of vehicles including car-

Printed: 20/8/2024 | 1 of 15

like robotic vehicles, tracked vehicles such as bulldozers and four-wheel-steer and four-wheel-drive vehicles. Kinematic and/or dynamic models of these vehicles will be used in developing simulation models. In addition, the course will also teach the interfacing of data acquisition systems, motion control systems, sensors such as inertial sensors, GPS sensors, laser sensors and encoders to facilitate sensing and actuation. The course has an extensive experimental content where the above developed software will be used to control either a tracked vehicle or a wheeled vehicle.

Course Aims

The course aims to teach students to develop software for substantially large projects so that they can appreciate what is required in developing software for commercial use.

Relationship to Other Courses

This course depends on the C and C++ knowlege gained form previours courses such as COMP1511 and MTRN2500. The programming knowlege acquired by following the above two courses are used to develop application software targetting robotic and mechatronic systems. The knowledge gained from this course can be used in other courses in the mechatronics and robotics disciples such as in robot design and advanced autonomous system or for thesis work.

Course Learning Outcomes

Course Learning Outcomes

CLO1: Apply structured and modular programming using C/C++.

CLO2: Understand data structures, data transfer and transmission as well as inter-process communication.

CLO3: Develop full software packages that are usable with commercial grade Mechatronic systems.

Course Learning Outcomes	Assessment Item
CLO1 : Apply structured and modular programming using C/C ++.	Continuous assessment using quizzesProgramming a PLCProgramming a UGV
CLO2 : Understand data structures, data transfer and transmission as well as interprocess communication.	Continuous assessment using quizzesProgramming a PLCProgramming a UGV
CLO3 : Develop full software packages that are usable with commercial grade Mechatronic systems.	Continuous assessment using quizzes Programming a PLC Programming a UGV

Printed: 20/8/2024 | 2 of 15

Learning and Teaching Technologies

Moodle - Learning Management System | EdStem

Learning and Teaching in this course

The students are required to follow in detail the pre-recorded videos. They contain the bulk of the course content and the videos provide the learning opportunities required to prepare for the quizzes. The other learning opportunity is created in the laboratory classes. The students are required to interact with the hardware in the laboratories. The knowledge acquired during the laboratory classes are helpful in preparing to face the quizzes. The lecture time slots can be used to have a face to face interaction with the lecturer for whose who wish to attend the workshop session in person.

Additional Course Information

This course heavily relies on your prior programming knowledge and C/C++ knowledge. The standard pre-requisite is MTRN2500.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Continuous assessment using quizzes Assessment Format: Individual	55%	Start Date: Not Applicable Due Date: in Weeks 04, 07 and 10
Programming a PLC Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Due in Week 05
Programming a UGV Assessment Format: Individual	25%	Start Date: Not Applicable Due Date: Weeks 08 and 11

Assessment Details

Continuous assessment using quizzes

Assessment Overview

Assessment length: Quiz 1 (self-paced learning quizzes - duration 2 weeks), Major Quiz 1 (40 mins), Major Quiz II (50 mins).

The 55 marks are broken down into 10 marks for self-paced learning quiz, 25 marks (Major Quiz Part I), 20 marks (Major Quiz Part II).

Printed: 20/8/2024 | 3 of 15

All quizzes will be done using Moodle platform and students can complete the quiz within the allocated time. The quizzes are unsupervised. The quizzes will be auto-marked by Moodle and the results released within 2 hours. The feedback is provided by Moodle itself.

Course Learning Outcomes

- CLO1: Apply structured and modular programming using C/C ++.
- CLO2: Understand data structures, data transfer and transmission as well as inter-process communication.
- CLO3: Develop full software packages that are usable with commercial grade Mechatronic systems.

Detailed Assessment Description

The content that will be included in the quizzes will come from; the video lectures, software developed as part of the video lectures, the lecture slides if any, the laboratory assignments and C, C++ and C++ CLR knowledge. The C++ compiler based on which the questions in the quizzes are made, is the compiler used by the Visual Studio 2022 community edition's integrated development environment. This is the compiler that will be used in all video lectures. No other compilers are used in this course.

Assessment Length

Quiz 1 (self paced learning quizzes - duration 2 weeks), Major Quiz I (40 mins), Major Quiz II (50 mins) + 5 mins minor quizzes in weeks 3-10.

Submission notes

Refer to guiz announcements for exact dates and times.

Assessment information

If a student does not attend the timed quizzes, and if the special consideration office approves their absence, then the supplementary examination is an invigilated written examination (not a quiz) that will he held at UNSW during the official supplementary examination period.

Programming a PLC

Assessment Overview

Each student will have access to a hardware set up built around a PLC which will be used as an interfacing device. They must develop software using C/C++ CLR to achieve effective interface and control.

Printed: 20/8/2024 | 4 of 15

The required effort is about 4 weeks of laboratory work and 12 hours of work outside the laboratory times totalling 20 hours.

As part of assessment the students are required to complete an in-class software task for which they get marks immediately and the demonstrators will provide immediate feedback. Their submitted assignments will be auto-marked as well as manually marked. The feedback will be provided by way of comments from the auto-marker.

Course Learning Outcomes

- CLO1: Apply structured and modular programming using C/C ++.
- CLO2: Understand data structures, data transfer and transmission as well as inter-process communication.
- CLO3: Develop full software packages that are usable with commercial grade Mechatronic systems.

Detailed Assessment Description

The detailed assessment description will be provided in the Assignment Specification that will be provided to the students. This specification will be posted on Moodle.

Submission notes

Electronic submission of zipped files.

Assignment submission Turnitin type

This is not a Turnitin assignment

Programming a UGV

Assessment Overview

The students must demonstrate inter-process communication, sensor interfacing and vehicle control using software written in C++ CLR.

This assignment has a progress check for which you get part of the marks for this assessment.

The students are required to submit the assessment to a Moodle submission site. The performance of their software will be assessed by the demonstrators in-class and the marks will be immediately allocated and verbal feedback will be given during the assessment.

The required effort is about 4 weeks of laboratory work and 12 hours of work outside the laboratory times, totalling 20 hours.

Course Learning Outcomes

- CLO1: Apply structured and modular programming using C/C ++.
- CLO2: Understand data structures, data transfer and transmission as well as inter-process communication.

Printed: 20/8/2024 | 5 of 15

 CLO3: Develop full software packages that are usable with commercial grade Mechatronic systems.

Detailed Assessment Description

Detailed inforamtion of the Assignment will be provided in the assignment specification. This will be made available to the students well ahead of time. It will be made available through Moodle.

Assessment Length

unspecified

Submission notes

Submission of specified files.

Assessment information

This assignment has a progress check for which you get part of the marks for this assessment. Please check the Assignment 2 specification.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

General Assessment Information

The students are strongly encouraged to attend the laboratory classes every week. The development of the solutions to the assignments require continuous laboratory work and involvement with the equipement in the laboratory. The students are required to demonstrate the proper functioning of the software developed by them while interacting with the hardware systems available in the laboratories. Therefore, it is absolutely essential that the students interact with the hardware systems provided to them in the laboratories continually.

Re-weighting is not an option for the school.

Grading Basis

Standard

Requirements to pass course

To pass this course a student should score 50 marks or above out of a total of 100 marks.

Printed: 20/8/2024 | 6 of 15

Course Schedule

Teaching Week/Module	Activity Type	Content	
Week 1 : 11 September - 15 September	Lecture	This week there will be a lecture and demonstration of the assignments you are expected to complete. The lecture will not contain any subject matter, but will contain administrative information as well as the lab work demonstration. The subject matter related to this week will already be on Moodle by way of a series of videos. The students must watch the videos related to Week 01. These can be found in Moodle and will be clearly marked under Week 01.	
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will start work on the first Assignment, the submission of which is due during your laboratory timeslot in Week 05.	
	Assessment	Students must work on the self-paced quizzes embedded in the learning modules titled Introductory Modele 1, Module 2 and Module 3. They must be completed before Week 04.	
Week 2:18 September - 22 September	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop.	
		The students must watch the videos related to Week 02. These can be found in Moodle and will be clearly marked under Week 02.	
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will start work on the first Assignment, the submission of which is due during your laboratory time slot in Week 05.	
	Assessment	Students must work on the self-paced quizzes embedded in the learning modules titled Introductory Modele 1, Module 2 and Module 3. They must be completed before Week 04.	
Week 3: 25 September - 29 September	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop.	
		The students must watch the videos related to Week 03. These can be found in Moodle and will be clearly marked under Week 03.	
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will start work on the first Assignment, the submission of which is due during your laboratory time slot in Week 05.	
	Assessment	Students must work on the self-paced quizzes embedded in the learning modules titled Introductory Modele 1, Module 2 and Module 3. They must be completed before Week 04.	
Week 4 : 2 October - 6 October	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. The students must watch the videos related to Week 04. These can be found in Moodle and will be clearly marked under Week 04.	
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will start work on the first Assignment, the submission of which is due during your laboratory time slot in Week 05.	
	Assessment	Self paced quizzes embedded in the learning modules titled Introductory Module 1, Module 2 and Module 3 must be completed by 6 October 2023 11:59 PM. Students must work on these modules well ahed of time to be able to complete them on-time.	
Week 5:9 October - 13 October	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. The students must watch the videos related to Week 05. These can be found in Moodle and will be clearly marked under Week 05.	
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You may start work on the second Assignment,	

Printed: 20/8/2024 | 7 of 15

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		the submission of which is due during your laboratory time slot in Week 11.
	Assessment	The students must demonstrate their Assignment 1 during their individual scheduled lab times of Week 05. Immediately after the demonstration of their software, they must submit there software modules to Turnitin in Moodle.
Week 6:16 October - 20 October	Other	There will be no activity this week. A sub-group of students may be chosen to go on industry visits.
Week 7 : 23 October - 27 October	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. The students must watch the videos related to Week 07. These can be found in Moodle and will be clearly marked under Week 07.
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will work on the second Assignment, the submission of which is due during your laboratory time slot in Week 11.
	Assessment	Major Quiz Part 1 Date:26 October 2023 Start Time: 6:05 pm. Finish Time: 6:57 pm Duration: 50 mins Marks: 25 Test content: Weeks 01 - 05 content from pre-recorded lecture videos, lecture slides, sample source code, laboratory classes, sample quizzes, C, C++ and C++/CLR knowledge. Please note the following: This is a compulsory assessment component and you MUST do it. This is an examination and all usual examination rules apply. This quiz is an online quiz and may be taken from anywhere in the world. You may use, Visual Studio, MTRN3500 Moodle page and its content, and programming resources and calculators. You must not seek assistance from anyone else using whatever means during the test. This will amount to academic misconduct and if found guilty, your mark will be zero. The quiz is timed. You will get 50 minutes for the Quiz and two minutes to log in. Marks for each question are mentioned in the question itself. Choose the best answer out of the four given choices or enter the correct answer in the space provided. Wrong answers do not deduct marks Marks will be released on Thursday 26 October 2023 by 9.00 pm. Compiler applicable to all questions is the Visual Studio 2022 Community edition C++ compiler and not any other compiler.
Week 8 : 30 October - 3 November	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. The students must watch the videos related to Week 08. These can be found in Moodle and will be clearly marked under Week 08.
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will work on the second Assignment, the submission of which is due during your laboratory time slot in Week 11.
	Assessment	Students must complete progress check on Assignment 2, during the their laboratory classes of this week. The students will awarded marks for this progress check.
Week 9 : 6 November - 10 November	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. The students must watch the videos related to Week 09. These can be found in Moodle and will be clearly marked under Week 09.
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex for your laboratory class. You will work on the second Assignment, the submission of which is due during your laboratory time slot in Week 11.
Week 10 : 13 November - 17 November	Workshop	The lecturer will be available in the lecture theatre during the lecture time to provide you help if needed. Please bring your problems associated with learning you do with lecture videos or in the laboratory classes. The time spent will be in the form of a software development workshop. There will be no video lectures for this week.
	Laboratory	The laboratory classes will be on this week. Please find the laboratory time slot you have enrolled yourself into and be there in Lab212 of Willis Annex
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Printed: 20/8/2024 | 8 of 15

	for your laboratory class. You will work on the second Assignment, the submission of which is due during your laboratory time slot in Week 11.
Assessment	Major Quiz Part 2 Date: 16 November 2023 Start Time: 6:05 pm. Finish Time: 6:57 pm Duration: 40 mins Marks: 20 Test content: Weeks 6 - 10 content from pre-recorded lectures, lecture slides, class lectures, laboratory classes, Assignment 2, self assessment quizzes, C, C++ and C++/CLR knowledge. Please note the following: This is a compulsory assessment component and you MUST do it. This is an examination and all usual examination rules apply. This quiz is an online quiz and may be taken from anywhere in the world. You may use, Visual Studio, MTRN3500 Moodle page and its content, and programming resources and calculators. You must not seek assistance from anyone else using whatever means during the test. This will amount to academic misconduct and if found guilty, your mark will be zero. The quiz is timed. You will get 40 minutes for the Quiz and two minutes to log in. Marks for each question are mentioned in the question itself. Choose the best answer. Wrong answers do not deduct marks Marks will be released on Thursday 16 November 2023 by 9.00 pm. Compiler applicable to all questions is the Visual Studio 2022 Community edition C++ compiler and not any other compiler.

Attendance Requirements

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

General Schedule Information

Note that for this course, the complete lecture content will be pre-recorded. The lecture videos are generally available before the lecture. It is absolutely essential that the students watch and learn from these videos and also practice software writing following the software development that takes place in the videos. To facilitate this, the students will be provided the software files so they can integrate them to their own learning they do with software development. The lecture time slot will be used to allow students to come and seek help or advise from the lecturer so that they can improve their software developement skills.

The lecturer will be available at the designated lecture theater during the lecture time slot, unless announced otherwise. Please note that there will be no recordings of the work that will be done during the lecture times as the work done by the lecturer during the lecture time slots are carried out based on the individual students' needs.

Course Resources

Prescribed Resources

Through Moodle the students will have access to pre-lecture video content, lecture slides,

Printed: 20/8/2024 | 9 of 15

sample programs, and hardware documentation and Quizzes.

Edstem will be used for forums.

Recommended Resources

Online resources of C/C++ programming.

UNSW Library website: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/course/view.php?id=69481

Course Evaluation and Development

The total number of students in this course is around 180 students. However, there are only 24 hardware stations available for students to use during the laboratory classes. But this may not be sufficient. Hence installable graphical simulators were developed and are now available to students to use when the real hardware is not available, for example, when working from home. The students can seamlessly port across the software they develop to interact with the similator to interact with the physical hardware made available for them during the lab classes.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Jay Katupiti ya		510E Ainsworth Building	9385 4096	Arranged via email or teams messages	No	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that 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 enough to do so and cannot later

Printed: 20/8/2024 | 10 of 15

apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own*.

Printed: 20/8/2024 | 11 of 15

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

Weekly online tests or laboratory work worth a small proportion of the subject mark;

Printed: 20/8/2024 | 12 of 15

Exams, peer feedback and team evaluation surveys;

- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that
 has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

<u>Engineering Student Support Services</u> – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

<u>UNSW Future Students</u> – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 - Nucleus Student Hub

(+61 2) 9385 7661 - Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

Printed: 20/8/2024 | 13 of 15

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00-5:00pm, Monday-Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 - Nucleus Student Hub

(+61 2) 9385 7661 - Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 - School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services - current student enquiries

• e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students - potential student enquiries

• e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

NB: the relevant teams listed above must be contacted for all student enquiries. The School
will only be able to refer students on to the relevant team if contacted

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services
- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook

Printed: 20/8/2024 | 15 of 15