MTRN4010 ADVANCED AUTONOMOUS SYSTEMS
and
MTRN9222 ARTIFICIALLY INTELLIGENT MACHINES

COURSE OUTLINE

COURSE STAFF

Contact details and consultation times for course convener

Dr Jose E Guivant
Room ME308 (Building J17)
Tel (02) 9385 9820
Email j.guivant@unsw.edu.au

Consultation times will be agreed with the students during week 1.
Consultations are possible outside set times, but a prior appointment with the lecturer will be appreciated. Blackboard discussion forum and emails are recommended as well.

COURSE INFORMATION

Units of credit: This is a six unit-of-credit (UoC) course.

Timetable

Laboratory/Project Work (Weeks:2-4,5-13)(Place L220, J18)

- T1 6756 F13A Fri 13:00 - 15:00
- T1 6752 H09A Thu 09:00 - 11:00
- T1 6753 H11A Thu 11:00 - 13:00
- T1 6754 H13A Thu 13:00 - 15:00
- T1 6757 M12A Mon 12:00 - 14:00
- T1 6755 T09A Tue 09:00 - 11:00

Lecture (Weeks:1-4,5-12)
Date and Time: Wednesdays, 12:00 - 14:00
Place: Red Centre Central Wing M032 (K-H13-M032)

Tutorials (Weeks:2-4,5-13)

Place Mechanical Eng 402 (K-J17-402)

- T1 6760 H15A Thu 15:00 - 16:00
- T1 6759 M16A Mon 16:00 - 17:00
- T1 6761 T12A Tue 12:00 - 13:00
- T1 6758 W15A Wed 15:00 - 16:00
There will be different arrangements for the tutorial activities throughout the semester. You will be informed about them in lecture classes and via Blackboard announcements.

**Parallel teaching** There will be no parallel teaching.

**Description:**

The course is aimed at learning basic and advanced techniques necessary for the sensing and control of autonomous systems. Contents covered in this course are the theory and application of topics such as Stochastic Processes, State Estimation, Sensor Data Fusion, Fuzzy Logic, Particle Swarm Optimization (PSO), Dynamic Programming, Neural Networks. Half of the course is lecture-based. In the other half students apply the concepts on a UGV (Unmanned Ground Vehicle).

**Course aims**

The following are the course objectives:

* Understanding of the problem of Modelling and Estimation of Stochastic Dynamical Processes, in particular for Robot Perception and Localization.
* Understand the Implementation of stochastic Data Fusion for solving Engineering Problems.
* Be able to implement simulations and real systems for the control and estimation of processes such a mobile robotic platform.
* Enable students to work individually and in groups to improve problem-solving skills.

Concepts included in this course are useful for other disciplines, in research, development and application.

**Graduate attributes**

UNSW’s graduate attributes are shown at [https://my.unsw.edu.au/student/atoz/GraduateAttributes.html](https://my.unsw.edu.au/student/atoz/GraduateAttributes.html) and are:

1. * the skills involved in scholarly enquiry;
2. * an in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context;
3. * the capacity for analytical and critical thinking and for creative problem solving;
4. the ability to engage in independent and reflective learning;
5. * information literacy — the skills to locate, evaluate and use relevant information;
6. the capacity for enterprise, initiative and creativity;
7. an appreciation of, and respect for, diversity;
8. * a capacity to contribute to, and work within, the international community;
9. the skills required for collaborative and multidisciplinary work;
10. an appreciation of, and a responsiveness to, change;
11. a respect for ethical practice and social responsibility; and
12. * the skills of effective communication.
These broad graduate attributes are contextualised for the discipline of engineering and shown at


In this course you are expected to improve Attributes 1, 2, 3, 5, 8 and 12.

Student-centred and self-directed learning (expectations of the students)
In addition to the course contact hours and group assignment work, it is expected that the student will spend, on average, an additional three hours per week of his/her own time. This time should be spent in revising the lecture material and further reading, implementing problems of the tutorials and completing projects.

ASSESSMENT

The final mark will be awarded in function of the exam and the project component composed by the experiments, projects and reports. The exam will cover material presented in lectures and laboratory. To achieve a pass in the course you must have satisfactory laboratory marks (at least 45% of the total laboratory marks) and a satisfactory mark in the exam (at least 50%).

Project component is composed by the following items:
* Three (3) Laboratory tasks #1,2,3 15% (Distributed during weeks 2,3,4,5)
* Project#1 20% Due on Week 7
* Project#2 45% Due on Week 12
* Reports 20%

Based on the following rules:
Constraints: Exam >=50% and Project >=45%
Final mark = PartA*k + PartB*(1-k);
k=0.6
PartA = max( Exam, Project )
PartB = min( Exam, Project )

All marks are expressed in scale [0,100].

A standard specification is available from the School office to aid presentation of your assignments (in all courses). All submissions should have a standard School cover sheet. All submissions are expected to be neat and clearly set out. Late submissions will not be accepted unless prior dispensation has been given; i.e. see the lecturer before the due date to avoid penalties.

Lectures will contain the following topics:

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<th>Week</th>
<th>Topic</th>
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Weeks 5,6 Solving estimation problems via optimization processes.

Weeks 6,7 Data Fusion applied to Localization, tracking and Mapping.

Weeks 7,8 Particle Swarm Optimization (PSO)

Weeks 9,10 Neural Networks

Weeks 10,11 Model Predictive Control

The schedule shown may be subject to change at short notice to suit exigencies.

RESOURCES FOR STUDENTS

Recommended Books
Electronic copies of Notes, Book chapters and research papers will be provided in the BlackBoard system.

Equipment
Sensors, robots and desktop computers are provided in the Laboratory.
All the computers will be installed with XP OS and Matlab for the laboratory experiments.
Students are allowed to use their personal laptops. Software for communication with the sensors and robots will be provided.
ACADEMIC HONESTY AND PLAGIARISM

What is Plagiarism?
Plagiarism is the presentation of the thoughts or work of another as one’s own.* Examples include:

• direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
• paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
• piecing together sections of the work of others into a new whole;
• presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
• claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

• correct referencing practices;
• paraphrasing, summarising, essay writing, and time management;
• appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students 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 items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.

Additional information provided in Blackboard Learn
This course has a website on Blackboard Learn. Students will be able to view their marks, download some course material, receive announcements from the lecturers and the system management staff, and to engage in discussions about relevant topics.

**CONTINUAL COURSE IMPROVEMENT**

Periodically student evaluative feedback on the course is gathered using, among other means, UNSW’s Course and Teaching Evaluation and Improvement (CATEI) process. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback.

**EXPECTATIONS OF STUDENTS**

Attendance in lectures or tutorials is strongly recommended. Failure to be present will mean you miss out on a great deal of extra information not necessarily obvious from the notes and tutorial questions. Discussions with the lecturer are always welcome, but not among the students. Mobile phones should be switched OFF at all times. Late arrivals should be avoided at any cost, and, only when really necessary, students should enter the classroom but with minimal disruption to the lecture. Attendance in tutorials is also highly recommended.

Laboratory work: During the exercise it is crucial that you closely follow the sound engineering practice – not to be late for the experiment, to comply with the OH&S regulations and to obey the instructions given by the laboratory staff and demonstrators.

**Calculators**

A significant part of the final exam, mid-session tests and quizzes will require analytical work, which, in turn, will require the use of calculators. You will need to provide your own calculator, of a make and model approved by UNSW, for the examination. The list of approved calculators is shown at: [https://my.unsw.edu.au/student/academiclife/assessment/examinations/Calculator.html](https://my.unsw.edu.au/student/academiclife/assessment/examinations/Calculator.html)

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an “Approved” sticker for it from the School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an Approved sticker will not be allowed into the examination room.

For details of applying for special consideration and conditions for the award of supplementary assessment see *Administrative Matters for All Courses*, available from the School office as part of *The Guide*, or on the School website.

**Information on relevant Occupational Health and Safety policies and expectations:**

[www.ohs.unsw.edu.au](http://www.ohs.unsw.edu.au)

**Equity and Disability**

Students who have a disability which 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 Student Equity and Disability Unit (SEADU) by phone on 9385 4734, email seadu@unsw.edu.au or via the website www.studentequity.unsw.edu.au. The office is located on the Ground Floor of the Goodsell building (F20).

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.

December 2012
Jose Guivant