

# NWEN301 (2018) - Operating Systems Design

## Prescription

This course addresses the design and implementation of operating systems, and examines fundamental concepts such as resource management, concurrency, protection and security. Examples drawn from a range of modern operating systems illustrate these concepts and project work provides practical experience in the design and implementation of operating systems.

## Course learning objectives

Students who pass this course should be able to:

1. Explain what an operating system is, what it does, and how it is designed and constructed,
2. Explain the process concept, lifecycle and concurrency models central to OS design,
3. Explain process scheduling, interprocess communication, process synchronization and deadlock handling,
4. Explain memory management schemes, such as segmentation, paging and virtual memory, and
5. Explain basic mechanisms for protection and system security.
6. Demonstrate the ability to write operating system code (GA 3(d) & 3(f)),
7. Explain the design choices such as the selection of algorithms within an operating system kernel (GA 3(b)),
8. Establish a practical understanding of a large body of production quality code (GA 3(f)), and,
9. Demonstrate familiarity with UNIX/Linux, C programming, APIs and System Calls (GA 3(f)).

## Withdrawal from Course

Withdrawal dates and process:

<https://www.victoria.ac.nz/students/study/course-additions-withdrawals>

## Lecturers

Qiang Fu (Coordinator)

[qiang.fu@vuw.ac.nz](mailto:qiang.fu@vuw.ac.nz)

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414 Alan MacDiarmid Building, Kelburn

## Teaching Format

During the trimester there will be two lectures per week and three one-hour lab sessions per week from week 2 to week 12. Tutorials will be scheduled as needed.

## Student feedback

Student feedback on University courses may be found at:

[www.cad.vuw.ac.nz/feedback/feedback\\_display.php](http://www.cad.vuw.ac.nz/feedback/feedback_display.php)

## Dates (trimester, teaching & break dates)

- Teaching: 05 March 2018 - 08 June 2018
- Break: 23 April 2018 - 27 April 2018

- Study period: 11 June 2018 - 14 June 2018
- Exam period: 15 June 2018 - 04 July 2018

## Class Times and Room Numbers

### 05 March 2018 - 25 March 2018

- **Thursday** 12:00 - 12:50 – LT206, Easterfield, Kelburn
- **Friday** 12:00 - 12:50 – LT101, Murphy, Kelburn

### 05 March 2018 - 01 April 2018

- **Tuesday** 12:00 - 12:50 – LT103, Hugh Mackenzie, Kelburn

### 02 April 2018 - 22 April 2018

- **Thursday** 12:00 - 12:50 – LT206, Easterfield, Kelburn
- **Friday** 12:00 - 12:50 – LT101, Murphy, Kelburn

### 09 April 2018 - 22 April 2018

- **Tuesday** 12:00 - 12:50 – LT103, Hugh Mackenzie, Kelburn

### 30 April 2018 - 10 June 2018

- **Tuesday** 12:00 - 12:50 – LT103, Hugh Mackenzie, Kelburn
- **Thursday** 12:00 - 12:50 – LT206, Easterfield, Kelburn
- **Friday** 12:00 - 12:50 – LT101, Murphy, Kelburn

## Other Classes

Three one-hour lab sessions per week from week 2 to week 12. Tutorials will be scheduled as needed.

## Set Texts and Recommended Readings

### Required

- Andrew S Tanenbaum Herbert Bos, *Modern Operating Systems: Global Edition (4e)*, Pearson Higher Ed. (Copies are held in the library.)

## Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 50%, students must:

- achieve a minimum **D** grade in the examination.

*If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.*

## Assessment

This course will be assessed through the following:

- Homework
- Projects
- Final Examination

Four homework assignments will be set from the text book. These will help focus your learning and exam preparation and contribute 2.5% ea to your final mark.

There are three projects for NWEN301. All projects use Pintos, which is a simple operating system framework for the 80x86 architecture. It supports kernel threads, loading and running user programs, and a file system, but it implements all of these in a very simple way. In the Pintos projects, you will extend the core Pintos implementation to make the OS much more functional (and useable). These projects are challenging, and require you to brush up on your C skills as well as your understanding of operating systems - the best advice is to start them early and attend your labs.

- In project 1 you will familiarize yourself with the Pintos development environment, permitting you to compile, build, execute and debug your kernel. You will also implement a more efficient thread wait

(alarm).

- In project 2 you will implement a better thread scheduler.
- In project 3 you will implement a range of system calls, which will then allow you to write your own simple user programs which will execute on Pintos. Congratulations, your OS is limited, but operational!

The programming projects have been selected to emphasise and cement important operating systems concepts through practice, in particular fulfil learning objects 6-9.

The exam will focus on learning objectives 1-5, in particular your ability to demonstrate your understanding of the broader operating systems concepts and related theory.

Homework (x4)	Weeks 3, 6, 9, 12	CLO:	10%
Project 1	Week 4	CLO:	5%
Project 2	Week 8	CLO:	15%
Project 3	Week 12	CLO:	15%
Final Examination (2 hours)		CLO:	55%

## Penalties

Project work will be penalised at a rate of 10% per day late, up to a limit of 5 days late, after which the work will not be accepted for marking.

Homework will not be accepted after the tutorial at which the solutions are distributed. Work submitted late, but prior to the tutorial will be penalised at 10% per day.

## Extensions

Individual extensions will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required.

## Submission & Return

All homework must be submitted online in PDF - work submitted in any other format will NOT be marked. Hand written and/or annotated work can be scanned to PDF for submission. Our goal is to return homework to you within 3 weeks of submission.

All project works must be submitted via the electronic submission system.

## Workload

In order to maintain satisfactory progress in NWEN 301, you should plan to spend an average of 10 hours per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures: 2 hours
- Project work: approx. 3 hours
- Homework assignment: 1 hour
- Independent study: approx. 4 hours

## Teaching Plan

See [https://ecs.victoria.ac.nz/Courses/NWEN301\\_2018T1/LectureSchedule](https://ecs.victoria.ac.nz/Courses/NWEN301_2018T1/LectureSchedule)

## Communication of Additional Information

All online material for this course can be accessed at [https://ecs.victoria.ac.nz/Courses/NWEN301\\_2018T1/](https://ecs.victoria.ac.nz/Courses/NWEN301_2018T1/)

## Links to General Course Information

- Academic Integrity and Plagiarism: <https://www.victoria.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.victoria.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.victoria.ac.nz/students/study/dates>
- Grades: <https://www.victoria.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.victoria.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.victoria.ac.nz/about/governance/strategy>
- Student support: <https://www.victoria.ac.nz/students/support>
- Students with disabilities: [https://www.victoria.ac.nz/st\\_services/disability/](https://www.victoria.ac.nz/st_services/disability/)
- Student Charter: <https://www.victoria.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.victoria.ac.nz/study/apply-enrol/terms-conditions/student-contract>
- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.victoria.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

**Offering CRN:** [17180](#)

**Points:** 15

**Prerequisites:** NWEN 241, 342 (or 242)

**Duration:** 05 March 2018 - 04 July 2018

**Starts:** Trimester 1

**Campus:** Kelburn