



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 (GA 3(b)).
2. Explain the process concept, lifecycle and concurrency models central to OS design (GA 3(b)).
3. Design appropriate mechanisms for process scheduling, interprocess communication, process synchronization and deadlock handling (GA 3(a), 3(b), 3(c), 3(d), 3(e)).
4. Design memory management schemes, such as segmentation, paging and virtual memory (GA 3(a), 3(b), 3(c), 3(d), 3(e)).
5. Explain basic mechanisms for protection and system security (GA 3(b)).
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)).
9. Demonstrate familiarity with UNIX/Linux, C programming, APIs and System Calls (GA 3(f)).

Course content

The course is primarily offered in-person, but there will also be a remote option and there will be online alternatives for all the components of the course for students who cannot attend in-person.

Students taking this course remotely must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the programming required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

If the assessment of the course includes tests, the tests will generally be run in-person on the Kelburn campus. There will be a remote option for students who cannot attend in-person and who have a strong justification (for example, being enrolled from overseas).

The remote test option will use Zoom for online supervision of the tests and you must be able to use Zoom with a camera, microphone, and screen-sharing. Students who will need to use the remote test option must contact the course coordinator in the first two weeks to get permission and make arrangements.

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Withdrawal from Course

Withdrawal dates and process:

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

Lecturers

Kris Bubendorfer (Coordinator)

kris.bubendorfer@vuw.ac.nz 04 4636484

403 Cotton Bldg Gate 7 Kelburn Parade, Kelburn

Teaching Format

This course will be offered in-person and online. For students in Wellington, there will be a combination of in-person components and web/internet based resources. It will also be possible to take the course entirely online for those who cannot attend on campus, with all the components provided in-person also made available online.

During the trimester there will be two online lectures per week and two hours of supervised in-person lab sessions per week from week 3 to week 10.

Student feedback

Student feedback on University courses may be found at:

www.cad.vuw.ac.nz/feedback/feedback_display.php

Dates (trimester, teaching & break dates)

- Teaching: 05 July 2021 - 08 October 2021
- Break: 16 August 2021 - 29 August 2021
- Study period: 11 October 2021 - 14 October 2021
- Exam period: 15 October 2021 - 06 November 2021

Class Times and Room Numbers

05 July 2021 - 15 August 2021

- **Tuesday** 11:00 - 11:50 – 104, Alan MacDiarmid Building, Kelburn
- **Wednesday** 11:00 - 11:50 – 104, Alan MacDiarmid Building, Kelburn

30 August 2021 - 10 October 2021

- **Tuesday** 11:00 - 11:50 – 104, Alan MacDiarmid Building, Kelburn
- **Wednesday** 11:00 - 11:50 – 104, Alan MacDiarmid Building, Kelburn

Other Classes

You will need to sign up for a weekly 2 hour lab session, starting in week 3.

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 final examination or test, to demonstrate achievement of all the CLOs of the course.

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

Four homework assignments will be set from the text book. These will help focus your learning and exam preparation and contribute 5% ea to your final mark. Assignments will be due on Mondays.

There are two 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.

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

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

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Homework assignments (x 4) (3-6 hours each)	Mondays, week 3,6,9,12	CLO: 1,2,3,4,5	20%
Project 1 (12-24 hours)	Week 6	CLO: 6,7,8,9	15%
Project 2 (12-24 hours)	Week 11	CLO: 6,7,8,9	20%
Test (2 hours duration)	During assessment period	CLO: 1,2,3,4,5	45%

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.

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 work is submitted through the ECS submission system, accessible through the course web pages. Marks and comments will be returned through the ECS marking system, also available through the course web pages

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
- Labs: 2 hours
- Project and assignment work: approx. 3 hours
- Independent study: approx. 3 hours

Teaching Plan

See https://ecs.wgtn.ac.nz/Courses/NWEN301_2021T2/LectureSchedule

Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/NWEN301_2021T2/

Links to General Course Information

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

Offering CRN: [17180](#)

Points: 15

Prerequisites: NWEN 241

Duration: 05 July 2021 - 07 November 2021

Starts: Trimester 2

Campus: Kelburn