TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

FACULTY OF ARCHITECTURE & DESIGN
Te Wahanga Waihanga-Hoahoa

2016

Trimester 1

COURSE OUTLINE

SARC 222

Structural Systems

GENERAL

Core; Trimester 1; 15 points

ASSESSMENT

60% internal by assignment and 40% exam
Note: Any hand-in dates scheduled in the exam period are tentative until the official exam timetable is available.

CLASS TIMES AND LOCATIONS

LECTURES: Wednesday and Friday 08:30 – 09:20 Room: VS LT1 and LT2

TUTORIALS: Wednesday and Friday 09:30 – 10:20 Rooms: VS 3.23 and 3.18

EXAMINATION: Will be held in the Trimester One examination period 10 June – 29 June

COORDINATOR

Coordinator

Name: Regan Potangaroa
Room: 2.13
Phone: 463 9530
Office Hours: By arrangement
Email:regan.potangaroa@vuw.ac.nz

Tutor details will be provided at start of the course.

COMMUNICATION OF ADDITIONAL INFORMATION

Any changes or additions to this Course Outline will be discussed and agreed with the class where practical and conveyed through Blackboard to all students enrolled in the course.

Blackboard automatically sends emails to your university-provided email address. **If you prefer to use another email address you must notify Blackboard immediately.** Otherwise you will miss out on vital information given out during the course. Please also note the need to ensure that your Victoria University address does not run out of space if you are 'working' and on-sending emails from your Victoria University email.

Changes to submission dates for items of assessment cannot occur without permission from the Head of School.

PRESCRIPTION

Introduction to the basic structural principles and material properties that underpin the fabric of natural and constructed environments. The course presents the basic requirements for structural systems; structural form and proportion; equilibrium; strength of materials; bending and shear; combined stresses; elasticity, plasticity and ductility; elastic deformation; buckling; structural design principles; and, elementary soil mechanics.

COURSE CONTENT

For a building to remain standing it must be structurally stable and possess sufficient strength and stiffness so it doesn't deflect too much. Hence to produce architecture and prepare for a career in building science an understanding of how buildings go together and knowledge of structures is essential. Structural considerations have a considerable impact on the forms, dimensions and materials of structural elements in a building, and as such are a significant influence in building science and on architectural design. An understanding of structural principles is therefore a key part of understanding buildings.

The course covers a broad range of structural forms and analyses of how they work, their advantages and, disadvantages. The content, specifically defined in the following list leads to understanding:-

- Types of trusses (shapes) and understanding of vertical and horizontal forces as vectors and equilibrium at a point using method of joints for analysis of simple determinate trusses.
- Loads, gravity loads, lateral loads and how structural elements carry loads – tension, compression, bending and shear, and torsion.
- How different structural forms distribute and carry loads
- How a building must have support for every part of it, using light timber frame buildings as an example.
- How earthquake and wind loads are affected by building location, size and mass, and how bracing elements must be distributed to resist lateral loads in any direction including torsional effects, using light timber frame buildings as an example.
- How different materials vary in structural properties including elastic and ductile behaviour.
- The advantages and disadvantages of different materials or combinations for structural performance, durability, and with reference to life cycle and energy costs.
- Knowledge of the section properties used in structural design and understanding of how section properties affect the strength of structural elements.
- The principles of equilibrium and finding reactions on simply supported and cantilever beams using equations of equilibrium.
- How shear force and bending moment diagrams vary along simply supported and cantilever beams for standard cases and how this can affect the shape and size of beams.
- How beams carry loads in bending and shear, designing beams and appreciating the effects of material types and section shapes.
- How beams deflect under load and by how much, including effects of material types and section shapes.
- Column crushing and buckling failure modes including effects of material types and section shapes.
- Soil classification, soil strength, and types of foundations for different soils, building types and sizes.
- Forces on retaining walls and how to prevent failure with emphasis on good drainage to improve the factor of safety.

COURSE LEARNING OBJECTIVES

Students who pass this course should be able to:
1. Analyse and design quantitatively determinate beams and trusses using basic principles of structural mechanics
2. Describe how beams of all materials resist loads, construct bending moment and shear force diagrams for determinate beams, and design quantitatively simple steel and timber beams.
3. Explain how structural loads are transferred through light-timber framed construction and design individual members using a New Zealand Standard.
4. Explain the following aspects of building structures; the relationship between structural form, materials and loads; basic soil mechanics, the structural behaviour of ties and columns and their spatial/architectural positioning.

GRADUATE SKILLS

Graduate Skills	***Taught***	***Practised***	***Assessed***
Knowledge			
• Information literacy		✓	✓
Creative and Critical Thinking			
• Problem solving	✓	✓	✓
• Critical evaluation	✓	✓	✓
• Work autonomously		✓	
• Creativity and innovation	✓	✓	
Communication			
• Effective communication (written)	✓	✓	✓
• Effective communication (oral)		✓	✓
• Effective communication (graphic)	✓	✓	✓
• Work effectively in a team setting			
Leadership			
• Ethical behaviour in social / professional / work environments		✓	
• Responsible, effective citizenship		✓	
• Commitment to responsibilities under the Treaty of Waitangi		✓	

TEACHING FORMAT

Two, one hour lecture sessions per week.

Two, one hour tutorial, practical exercise and/or building visit sessions per week. These will be tutorials with mathematical exercises, practical exercises and site visits.

MANDATORY COURSE REQUIREMENTS

MCR's are requirements, in addition to achieving a pass grade, that students must meet in order to pass a course.

- achieve a minimum of 40% in the final examination, in order to demonstrate that you have achieved the CLO's independently of any external assistance

WORKLOAD

You should expect to spend around 150 hours on this course, including both scheduled class time and independent study. Typically this involves around 11-12 hours per week during the twelve teaching weeks, with the balance during the mid- trimester break, study week, and examination period.

Attendance and participation is an important aspect of the learning process as there will be class discussions and interactions that will be critical to the ideas and concepts of structure and architecture. Thus, you are expected to attend all the lectures and tutorials.

If extraordinary circumstances arise that require you to be absent from some class sessions, you should discuss the situation with the Course Coordinator as soon as possible.

Students with course timetable clashes are responsible for discussing these with their Course Coordinators. Students who then choose to remain enrolled in such courses must recognise that it is their sole responsibility to seek information from peers, Blackboard and other sources, and catch up on course material they may miss because of clashes. Past experience suggests that students can have gaps in their appreciation of the topic.

ASSESSMENT

The second Assignment is assessed and graded A+, A, A-, B+, B, B-, C+, C, C-, D, E, (where C- is a PASS). Grades only are issued to students. The final grade for the course is based on the aggregation of the percentage marks for each of the assignments and the examination, and a final grade of C- or better is required to pass the course.

NOTE: In order to ensure equity, hand-in dates cannot be modified. A hand-in date cannot be changed without permission from the Head of School.

All work submitted for this course must be original and developed for this course only, unless prior approval is gained from the course coordinator to further develop existing work from previous or concurrent courses.

A brief description of the assignments and examination which contribute towards the final course grade follows:

Assignment 1: 10 Tutorial Tests throughout the trimester each of 2%	20%
Assignment 2: Light timber framing (5 Weeks: due 4 May)	40%
Final examination (between 10 to 29 June)	40%
Total	100%

Hand-in dates are also in the Schedule of Sessions and Assessments at the end of this document.

The submission requirements and assessment criteria for the 3 projects are as follows:

Assignment 1: (20%)

Brief description: These will be 'snap' tests run through the tutorials. They will relate to the current material being covered in the lectures and tutorials and will be short but succinct. They will be answered and handed in at the tutorial. No notice will be given as students are presumed to be at tutorials.

Assessment Criteria: Full marks (2%) will be awarded for the completion of the test. Inadequate or trivial answers will get 0% and anything in-between will be awarded 1%.

Assessment Criterion	CLO(s)
Demonstrating an understanding of the lecture material	**1 - 4**

Assignment 2: (40%)

Brief description:

- Design and specify bracing systems for a light timber frame structure
- Describe the force paths within a light timber frame building
- Design the gravity-supporting structure to support a light timber frame structure.
- Design a timber column and a steel tie to partially or fully support the weight of a small building

Submission Requirements:

A written report of between 6 to 8 pages with sketches as well as a completed bracing schedule for a house. Full details will be provided in the assignment hand-out.

NOTE: Assignment 2 must be submitted to the Hand-in folder on the R-Drive. This is a School of Architecture requirement to ensure that student work is appropriately archived.

Assessment Criteria:

	CLO(s)
Design and specify bracing systems for a light timber frame structure	**3**
Describe the force paths within a light timber frame building	**3**
Design the gravity-supporting structure to support a light timber frame structure.	**2 - 3**
Design a timber column and a steel tie to partially or fully support the weight of a small building	**4**

Examination: (40%)

Brief description: A closed-book three hour examination

Submission Requirements:

Completion of all sections of the examination

Assessment Criteria	**CLO(s)**
Correct understanding of all the materials presented in the course, such as lectures, exercises, site visits and readings, and the ability to apply them in appropriate situations.	**1 - 4**

The date of the exam will be available once the exam timetable is released.

All grades posted during this course are only provisional results until confirmed by the School Examiners Committee which meets after the examination period.

SUBMISSION AND RETURN OF WORK

All work submitted for assessment must be accompanied by an ASSESSMENT DECLARATION FORM. This will not be required for any of Assignment 1 as it will be in class but will be for Assignment 2. You are responsible for ensuring your work is submitted on time and in the required format.
All hand-ins must be submitted to the Hand-in folder on the R-Drive. This is a School of Architecture requirement to ensure that student work is appropriately archived.

Work submitted late must be submitted to the Course Coordinator.

Late submissions will be penalised as set out below, unless an extension is approved by Administrator Asmaa Bouhalba.

EXTENSIONS

In the event of illness or other extraordinary circumstances that prevent you from submitting and/or presenting a piece of work on time, or that you feel adversely affect the quality of the work you submit, you should complete an Application for Extension form (available from the Faculty Office, or online) for Administrator Asmaa Bouhalba to approve **before** the hand-in date. You must provide suitable evidence of your illness or other circumstances. In an emergency, or if you are unable to contact Asmaa, you should advise the Course Coordinator of your situation. Refer to additional information about extensions on Blackboard.

PENALTIES

For work that arrives late without an approved extension, the following penalty will be applied: 5% immediately, then 5% for every subsequent 24 hours including weekends.

REQUIRED MATERIALS AND EQUIPMENT

Students will need to provide all materials and equipment as necessary for the completion of required work. This will include a scientific calculator. Please check the website link below for general requirements:

www.victoria.ac.nz/fad/faculty-administration/current-students/faqs#materialsandequipment

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SET TEXTS

None

RECOMMENDED READING

The following readings are recommended for this course and all have been placed on 3-day loan.

Note that there are many other very helpful books on Structures in the library which you should refer to for additional information and examples.

Schodek, D.L. Structures. Prentice Hall. New Jersey. 3rd edn, 2008. TA645 S363 S

Benjamin, B.S. Structures for Architects. Van Norstrand Reinhold. 2nd edn. 1984. TA645 B468 S 2ed

Seward, D. Understanding Structures, Analysis, materials, design. MacMillan Press, 3rd edn. 2009. TA633 S514 U

SCHEDULE OF SESSIONS

Week Month	Day	Date	Item	Tutorial	Comments
Week 8 February	M	22			Orientation Week
	TU	23			
	W	24			
	TH	25			
	F	26			
Week 9 Feb/March	M	29			Trimester 1 Begins
	TU	1			
	W	2	Introduction	Exercise 1	
	TH	3			
	F	4	Equilibrium and section properties	Exercise 2	
Week 10 March	M	7			
	TU	8			
	W	9	Material Properties, stress, strain and ductility	Exercise 3	
	TH	10			
	F	11	Columns	Exercise 4	This is the last date that you can withdraw with a full fees refund
Week 11 March	M	14			
	TU	15			
	W	16	Light Timber Framing (Gravity 1)	Exercise 5	Handout Assignment 2
	TH	17			
	F	18	No Lecture	No Tutorial	**40Th Schools Anniversary celebrated on the 18-19th**
Week 12 March	M	21			
	TU	22			
	W	23	Light Timber Framing (Gravity 2)	Exercise 6	
	TH	24			
	F	25			Good Friday – Public Holiday
Week 13 March/ April	M	28			Easter Monday – Public Holiday
	TU	29			University Holiday
	W	30			
	TH	31			Trimester 1 resumes
	F	1	Light Timber Framing (Lateral 1)	Exercise 7	
Week 14 April	M	4			
	TU	5			
	W	6	Light Timber Framing (Lateral 2)	Exercise 8	
	TH	7			
	F	8	Virtual Site Visit and Assignment 2 Discussion	Assignment 2 Tutoring	
Week 15 April	M	11			
	TU	12			
	W	13	Beam Bending	Exercise 9 +Assign Tutoring	
	TH	14			
	F	15	Beam Bending Moments	Exercise 10 +Assign Tutoring	
Week 16 April	M	18			
	TU	19			
	W	20	Bending stress and strength	Exercise 11	
	TH	21			
	F	22	Beam design to NZ Codes	Exercise 12	
Week 17 April/May	M	25			Anzac Day Observed – Public holiday
	TU	26			Mid Trimester Break starts
	W	27			
	TH	28			
	F	29			Mid Trimester Break ends
Week 18	M	2			

May	TU	3			
	W	4	Beam Shear Stress	Exercise 13	Hand in Assignment 2
	TH	5			
	F	6	Beam Shear Strength	Exercise 14	
Week 19 May	M	9			
	TU	10			
	W	11	Beam Deflections	Exercise 15 + Site Visit (16)	
	TH	12			
	F	13	Loads and Structural Form	Exercise 15 + Site Visit (16)	After this date the Associate Dean's approval is required for withdrawals from Trimester 1 courses.
Week 20 May	M	16			
	TU	17			
	W	18	Material selection and form	Exercise 17	
	TH	19			
	F	20	Load paths	Exercise 18	
Week 21 May	M	23			
	TU	24			
	W	25	Trusses 1	Exercise 19	
	TH	26			
	F	27	Trusses 2	Exercise 20	
Week 22 June	M	30			
	TU	31			
	W	1	Soils 1	Exercise 21	
	TH	2			
	F	3	Soils 2	Exercise 22	
Week 23 June	M	6			Queen's Birthday – Public Holiday
	TU	7			Study Period
	W	8			
	TH	9			
	F	10			Mid-year Examinations begin
Week 24 June	M	13			
	TU	14			
	W	15			
	TH	16			
	F	17			
Week 25 June	M	20			
	TU	21			
	W	22			
	TH	23			
	F	24			
Week 26 June/July	M	27			
	TU	28			
	W	29			
	TH	30			Mid-year Examinations end
	F	1			Mid-year break begins
Week 27 July	M	4			
	TU	5			
	W	6			
	TH	7			
	F	8			
Week 28 July	M	11			Trimester 2 begins
	TU	12			
	W	13			
	TH	14			
	F	15			

CLASS REPRESENTATIVES

The Faculty of Architecture and Design operates a system of Class Representatives in 100-level courses, and Year Representatives in each of the professional disciplines. Student Representatives are elected during a class session in the first week of teaching. All Student Representatives will be listed on the STUDIO notice board in the Atrium, and the relevant Representatives are also listed on studio notice boards. Student Representatives have a role in liaising between staff and students to represent the interests of students to the academic staff, and also in providing students with a communication channel to STUDIO and the Student Representation organiser.

Class Rep name and contact details:

STUDENT FEEDBACK

Course feedback from last year indicated a preference for students being allocated a tutor group rather than being tutored by the pool of tutors. In response to the feedback, this year each student will be in a group led by one tutor.year. The Course Coordinator will discuss feedback from previous students at an appropriate time during the course.

Student feedback on University courses may be found at *www.cad.vuw.ac.nz/feedback/feedback_display.php*.

OTHER IMPORTANT INFORMATION

The information above is specific to this course. There is other important information that students must familiarise themselves with, including:

- Academic Integrity and Plagiarism: www.victoria.ac.nz/home/study/plagiarism
- Aegrotats: www.victoria.ac.nz/about/governance/dvc-academic/documents/aegrotat.pdf
- Academic Progress: www.victoria.ac.nz/home/study/academic-progress (including restrictions and non-engagement)
- Dates and deadlines: www.victoria.ac.nz/home/study/dates
- Faculty Current Students site: www.victoria.ac.nz/fad/faculty-administration/current-students
- Grades: http://www.victoria.ac.nz/students/study/progress/grades
- Resolving academic issues: www.victoria.ac.nz/about/governance/dvc-academic/documents/grievances.pdf
- Special passes: http://www.victoria.ac.nz/about/governance/dvc-academic/documents/special-pass-application-form.pdf
- Statutes and policies including the Student Conduct Statute: www.victoria.ac.nz/home/about/policy
- Student support: www.victoria.ac.nz/home/viclife/studentservice
- Students with disabilities: www.victoria.ac.nz/st_services/disability
- Student Charter: www.victoria.ac.nz/home/viclife/student-charter
- Student Contract: www.victoria.ac.nz/home/admisenrol/enrol/studentcontract
- Turnitin: www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: www.victoria.ac.nz/home/about
- VUWSA: www.vuwsa.org.nz

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Work Submitted for Assessment

Declaration Form

Student's full name :

Course :

Assignment/project :
(number and title)

Date submitted :

Refer to the information on Academic Integrity, Plagiarism and Copyright on the back of this form.
I confirm that:
I have read and understood the University's information on academic integrity and plagiarism contained at http: www.victoria.ac.nz/home/study/plagiarism and outlined below:

- I have read and understood the general principles of copyright law as set out below:
- This project/assignment is entirely the result of my own work except where clearly acknowledged otherwise:
- Any use of material created by someone else is permitted by the copyright owner.

Signed:

Date:

Academic Integrity, Plagiarism and Copyright

ACADEMIC INTEGRITY

Academic integrity is important because it is the core value on which the University's learning, teaching and research activities are based. University staff and students are expected to treat academic, intellectual or creative work that has been done by other people with respect at all times. Victoria University's reputation for academic integrity adds value to your qualification.

Academic integrity is simply about being honest when you submit your academic work for assessment

- You must acknowledge any ideas and assistance you have had from other people.
- You must fully reference the source of those ideas and assistance.
- You must make clear which parts of the work you are submitting are based on other people's work.
- You must not lie about whose ideas you are submitting.
- When using work created by others either as a basis for your own work, or as an element within your own work, you must comply with copyright law

Summarised from information on the University's Integrity and Plagiarism website:
www.victoria.ac.nz/home/study/plagiarism

PLAGIARISM

The University defines plagiarism as presenting someone else's work as if it were your own, whether you mean to or not. 'Someone else's work' means anything that is not your own idea. Even if it is presented in your own style, you must acknowledge your sources fully and appropriately. This includes:

- Material from books, journals or any other printed source
- The work of other students or staff
- Information from the internet
- Software programs and other electronic material
- Designs and ideas
- The organisation or structuring of any such material

Find out more about plagiarism, how to avoid it and penalties, on the University's website:
www.victoria.ac.nz/home/study/plagiarism

COPYRIGHT

Copyright law regulates the use of the work of an author, artist, designer or other creator.

- Copyright applies to created work including designs, music, computer programs, artistic and literary work.
- The work can be in printed, digital, audio, video or other formats.
- Normally the author or creator of a work owns the copyright for their lifetime and for 50 years after their death, (although sometimes someone other than the creator of a work owns the copyright to the work, such as the creator's employer, or a person who commissions the creator's work).
- You must have permission from the copyright owner to copy, alter, display, distribute or otherwise use created work.
- If the creator has applied a Creative Commons licence to a work, this permits others to use the work but only in accordance with that licence.

Further information on copyright is available on the Victoria University website:
http://library.victoria.ac.nz/library/about/policies/copyright.html