CVEN2301 Mechanics of Solids

Semester 1, 2016

Never Stand Still | Faculty of Engineering | School of Civil and Environmental Engineering

COURSE DETAILS

Units of Credit 6

Contact hours 5 hours per week

Class Tuesday, 10am - 12pm Clancy
Thursday 1pm – 2pm Clancy

Workshop problems ***Thursday 2pm – 4pm, 4pm – 6pm***

Room	Demonstrators	Time
Ainswth G01	Afshin Mellati, Chengwei Yang	Thursday 2pm-4pm
Ainswth 201	Albert Artha Saputra, David Soedibyo Hartanto	Thursday 2pm-4pm
Gold G16	Bambang Piscesa, Daniel O'Shea, Daniel Setioso,	Thursday 2pm-4pm
Gold G04	Binhua Wu, Ke He, Jeremy Tinslay	Thursday 2pm-4pm
Mat 130	Alireza Akbarzadeh, Jason Lam	Thursday 2pm-4pm
RedC M010	Athethhan Vigneswaran, David Morgan	Thursday 2pm-4pm
Ainswth G01	Afshin Mellati, Chengwei Yang	Thursday 4pm-6pm
Ainswth 201	Albert Artha Saputra, David Soedibyo Hartanto	Thursday 4pm-6pm
Gold G16	Bambang Piscesa, Daniel O'Shea, David Morgan	Thursday 4pm-6pm
Gold G04	Binhua Wu, Ke He, Athethhan Vigneswaran	Thursday 4pm-6pm
Mat 130	Alireza Akbarzadeh, Jason Lam	Thursday 4pm-6pm
Col LG01	Daniel Setioso, Jeremy Tinslay	Thursday 4pm-6pm

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Dr. David Kellermann

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Campus Map: Gold – Goldstein Hall D16; Ainswth – Ainsworth Building J17; Mat – Mathews F23; RedC – Red Center H13; Col – Colombo House B16;

http://www.facilities.unsw.edu.au/sites/all/files/KENC%20Campus%20Map_6.pdf

INFORMATION ABOUT THE COURSE

The aim of this course is to introduce you to the fundamental concepts and principles applied by engineers - whether Civil, Environmental, Mechanical, Aeronautical - in the design of structures of all sorts of sizes and purpose. We will build upon the mathematics, physics and statics courses of the first year, extending Newtonian Mechanics to address and understand the elastic and to certain extent inelastic behaviour of trusses, beams and frames. Also, we will aim to engage you in the formulation and resolution of open-ended, design-type exercises, thereby bridging the divide between scientific theories and engineering practice.

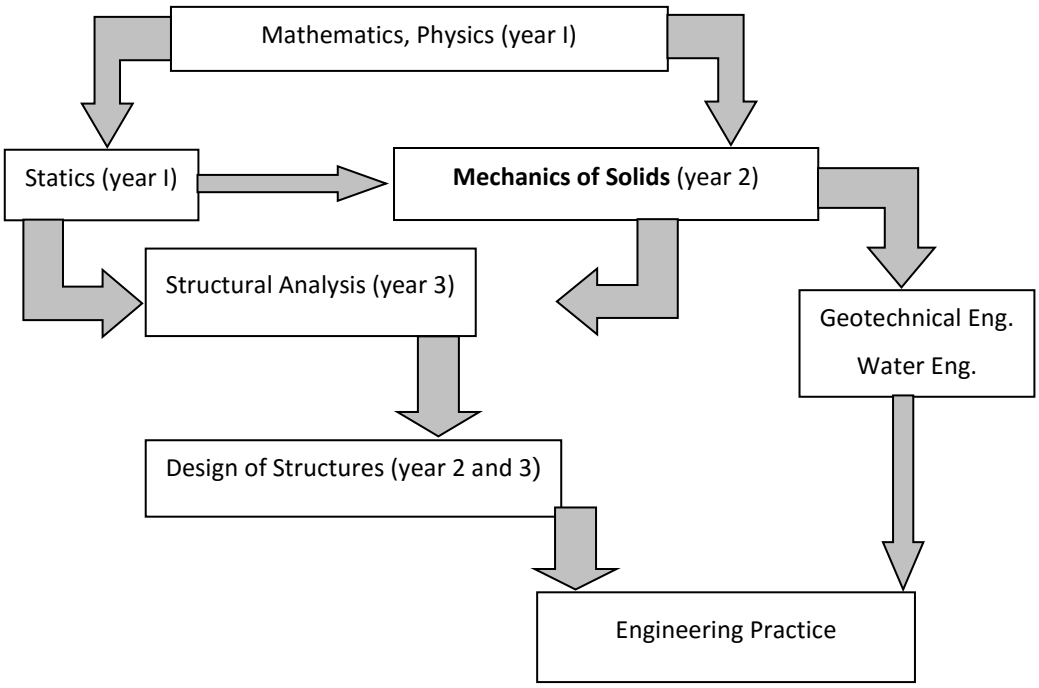
During this competency-based course you will be supported in developing the core skills, qualities and understandings

needed for more advanced courses in your program and associated with your role as a future Civil/Environmental Engineer.

This course will also provide you with opportunities to develop the following **graduate attributes**:

- the capacity for analytical and independent critical thinking;
- skills related to lifelong learning, such as self-reflection (ability to apply theory to practice in familiar and unfamiliar situations); and
- collaborative and teamwork skills.

How does this course relate to other course offerings in the discipline?



HANDBOOK DESCRIPTION

An introduction to the strength of materials: revision of statics and properties of sections; 3 dimensional statics; concepts of stress and strain; stress-strain relationships; bars under axial force, bending moment, shear force, torsion; deflections due to bending and shear; combined stresses; stresses and strains at a point; principal stresses and strains; failure criterion; slender column buckling.

Refer to Online Handbook available at:

http://www.handbook.unsw.edu.au/undergraduate/courses/2016/CVEN2301.html

OBJECTIVES

The objectives of this course are to:

- reinforce your knowledge of statics and to expand this knowledge in the areas of linear strain and stress analysis, thus enabling you to deal with more complex and integrated engineering problems involving Mechanics of Solids;
- to introduce you to the basic principles and laws underlying Mechanics of Solids;
- to familiarise you with the modelling and analysing techniques when formulating and solving problems for predicting the states of stress and strain for bodies in static equilibrium;
- to give you an opportunity to develop and reflect on graduate attributes such as critical thinking and problem solving, lifelong learning skills and collaborative skills.

TEACHING STRATEGIES

The teaching strategies that will be used and their rationale. Give some suggested approaches to learning in the course.

The teaching strategies that will be used include:

- **Lectures** that will focus on the development and application of generalised problem-solving processes for the stress, strain and deformation analysis of structures. Lectures will also emphasise the relationship of the content to the engineering practice and will provide an opportunity for reflection on learning.
- **Problem** classes will concentrate on strategies for solving such problems. You will be encouraged, from time to time, to work in small groups to solve problems.

Suggested approaches to learning in this course include:

- Regular participation in lectures and class problem sessions. *Review lecture and class problem material. Follow worked examples. Reflect on class problems and quizzes.*
- Weekly reading and recording of your learning.
- Appropriate preparation for class problem activities.
- Planning your time to achieve all assessment requirements (see assessment).
- We encourage you to work with your peers. A good way to learn the material is in small study groups. Such groups work best if members have attempted the problems individually before meeting as a group. A valued and honest collaboration occurs when, for example, you "get stuck" early on in attacking an exercise and go to your classmate with a relevant question. Your classmate then has the opportunity to learn from your question as well as help you. You then bring something to the collaboration. You can learn too from last years problem sets and quizzes if used as a check or corrective when you seem to have hit a dead end.
- Students who perform poorly in the quizzes are strongly encouraged to discuss their progress with the lecturers during the semester. Please do not suffer in silence – seek the help at an early stage! We would like you to make most of this learning process and receive a high grade in the course.

EXPECTED LEARNING OUTCOMES

After completing this course, the learning outcomes are:

1. Demonstrate an understanding of basic concepts and the role of Mechanics of Solids in the analysis and design of structures
2. Gain knowledge about the theoretical background that has led to the concept of stresses and strains
3. Understand and apply the concepts of stresses and strains to formulate and evaluate determinate and indeterminate axial force and bending moment problems; be able to evaluate stresses due to axial force, bending moment, shear and torsion in symmetrical and unsymmetrical cross-sections;
4. Calculate and evaluate beam deflections for statically determinate and indeterminate beams by using integration methods and step functions; be able to calculate shear and torsion stresses due to shear and torsion forces respectively
5. Calculate principal stresses, strains and combined stresses and draw Mohr's circle

These learning outcomes map to Engineers Australia Stage 1 Competencies 1.1 & 1.2

1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.

1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.

Self-centred and self-directed learning (expectations of the students):

In addition to the class problem sessions, you are expected to commit **6 - 8 hours per week** (1.5 hours for each hour of contact) to independent learning and general problem solving.

ASSESSMENT

Assessment will be based on **hand-in class problem sessions**, **one major quiz** and **a final exam**. These components will address problems consistent with those you are likely to face as professional Civil/Environmental Engineer.

- The purpose of **Hand-in class problem sessions** and **Quiz** will be to provide you with a clear study framework. It will also provide you with the opportunity to develop self-learning and problem solving skills. Hand-in class problem sessions and Quizzes will serve as a basis for discussion with your demonstrator and lecturer.
- *A mark* ***of at least 40%*** *in* ***the final examination*** *is required before the class work is included in the final mark.* The formal exam scripts will not be returned.

The relative value of each of the assessable tasks is as follows:

Hand-in class problem sessions:	**20%**
Mid-semester quiz:	**20%**
Final Exam:	**60%**
	100%

There are no exemptions from any part of this assessment. If you are repeating the subject you must complete all components this year.

Note: The course coordinator reserves the right to adjust the final scores by scaling if agreed to by the Head of School.

Assessment Mapping to Learning Outcomes:

AS → LO Mapping	**Learning Outcomes (LO)**				
Assessments (As)	LO1	LO2	LO3	LO4	LO5
As1 Hand-in class problems (20%)	4	4	4	4	4
As2 Mid-Semester Quiz (20%)	6.67	6.67	6.67	-	-
As3 Final Exam (60%)	3	3	18	18	18
Overall	13.67	13.67	28.67	22	22

RESOURCES

Reference

Hibbeler, R.C., Mechanics of Materials, SI Version 9th Edition. Pearson Education.

Additional Readings

Riley, W., Sturges L. and Morris D. (2007), Mechanics of Materials, 6th Edition, John Wiley & Sons.

Websites

www.mdsolids.com

Technology Enabled Learning and Teaching Wed Site and login to Moodle

http://telt.unsw.edu.au/
https://moodle.telt.unsw.edu.au/login/index.php

Pearson MasterEngineering

http://www.pearsonmylabandmastering.com/northamerica/masteringengineering/

UNSW Library Database

Access Engineering – platform of e-books, videos and interactive tables and graphs.
Look at the Curriculum Map and select “Strength of Materials”

CLASS PROBLEM SESSIONS

The class problem sessions begin in the 2nd week of semester. Each class will have a one, two or three demonstrators and we encourage you to develop a close working relationship with your demonstrator and the rest of your class problem group.

COURSE PROGRAM

Week	Topic	Assessment
1	Introduction. Revision of Statics. Geometric Properties of sections. (Equilibrium, FBD, BMD, SFD, AFD)	
2	Principal section properties.	**Class problem sessions start**
3	Concept of Stresses. Stress block.	**Hand In 1**
4	Concept of Strain. Mechanical properties of materials.	
	Mid-Semester Break 25th March to 3rd April	
5	Stresses and Deformation due to Axial Force. Indeterminate axial force problems.	**Hand In 2**
6	Bending stresses. Composite sections.	
7	Inelastic bending stresses.	**Mid-Semester QUIZ**
8	Beam deflections. Indeterminate beams.	
9	Shear stress in beams. Shear flow.	**Hand In 3**
10	Shear stress in thin-walled beams. Torsion.	
11	Torsion.	**Hand In 4**
12	Stress transformation, Principal stresses. Principal strains. Mohr's circle. 3-D Hook's law, Plane stress & Plane strain.	
13	Revision	**Class problem sessions finish**

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://my.unsw.edu.au/student/resources/KeyDates.html

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

COURSE EVALUATION AND DEVELOPMENT

The School of Civil and Environmental Engineering evaluates each course each time it is run through (i) the UNSW Course and Teaching Evaluation and Improvement (CATEI) process, and (ii) Focus Group Meetings.

As part of the CATEI process, your student evaluations on various aspects of the course are graded; the Course Coordinator prepares a summary report for the Head of School. Any problem areas are identified for remedial action, and ideas for making improvements to the course are noted for action the next time that the course is run.

Focus Group Meetings are conducted by the four Year Managers (academic staff) for any students who wish to attend, in each year of the civil and/or environmental engineering programs. Student comments on each course are collected and disseminated to the Lecturers concerned, noting any points which can help improve the course.

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism,

- School policy on Supplementary exams,
- Special Considerations,
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

Refer to Academic Advice on the School website available at:

http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice