School of Civil and Environmental Engineering

Term 2, 2021

ENGG1300
ENGINEERING MECHANICS

COURSE DETAILS			
Units of Credit	**6**		
Contact hours	6+ hours per week		
Class	Monday	2:00pm – 4:00pm	Face to Face (Mathews Theatre A) and Online
	Tuesday	3:00pm – 5:00pm	Face to Face (Mathews Theatre A) and Online
Workshop	Friday	10:00am – 12:00pm	Face to Face and Online
Laboratory	As scheduled in weeks 4 and 7		Face to Face (Room 102 in H20) and Online
Consultation	Friday	12:00pm – 1:00pm	Face to Face (Room 608 in H20) and Online

Course Coordinator and Lecturer

Prof. Wei Gao
email: w.gao@unsw.edu.au
office: Room 608 Civil and Environmental Engineering Building (H20)

Online Coordinator

Dr. Xiaojun Chen
email: xiaojun.chen@unsw.edu.au; office: CE616

For issues relating to *Moodle* or the *Online Learning Modules* please contact *Dr. Xiaojun Chen*

For *strictly private or confidential issues* please feel free to email *Prof. Wei Gao*

For issues related to the course content and assistance with solving worked problems and examples, please follow this process to resolve your queries:

1. **Ask your peers**! Collaborating with your fellow peers will help to resolve many problems
2. **Ask your demonstrators!** Take your questions to your next Tuesday Workshop session
3. **Discuss with your lecturer!** Do not hesitate to discuss your problems with *Wei* online or Face to Face during the Consultation session from 12-1pm on every Friday
4. **Post your problem to the Moodle Forum!** We will attempt to answer your problems. You are also encouraged to answer questions for your peers

When posting to the Moodle forum *please include screenshot of the problem*, and the Topic / Question Number in the title. Example: *"Workshop Week 1, Q1"*

INFORMATION ABOUT THE COURSE

The aim is to introduce students to the fundamental concepts and principles applied by engineers - whether civil, mechanical, mining, aeronautical, etc. - in the design of structures of all sorts of sizes and purpose. We build upon the mathematics and physics courses, extending Newtonian Mechanics to understand what happens to a body when force(s) is/are applied to it. Statics is a branch of mechanics that deals with the study of objects, structures, fluids in equilibrium. Dynamics is a branch of mechanics that deals with the study of bodies in motion.

This course will continue with and will build on the concepts introduced in Mathematics and Physics. During this course you will be supported in developing the core skills, qualities and understandings needed for more advanced courses in your program, such as Mechanics of Solids, Structural Analysis and Design, Geotechnical Engineering, Civil Engineering Practice and Special Topics in Concrete, Steel and Composite Structures subjects, and associated with your role as a future Civil/Environmental Engineer.

HANDBOOK DESCRIPTION

See link to virtual handbook*:*

https://www.handbook.unsw.edu.au/undergraduate/courses/2021/engg1300/

OBJECTIVES

The objectives of this course are to:

- build on your knowledge in Mathematics and Physics to encompass the fundamental concepts of Statics and Dynamics
- introduce you to thinking processes for practical Engineering Problems
- give you opportunities to develop and reflect on graduate attributes such as collaborative skills, communication skills, and lifelong learning skills.

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)
- collaborative and teamwork skills.

TEACHING STRATEGIES

This course is designed for student-centred learning. Students are encouraged to think critically to solve engineering problems and to ask questions. Students should participate both with the online content and in-class in order to best achieve the learning outcomes

The following teaching strategies are implemented in this course:

- **Lectures**

  Focus on the development and application of generalised problem-solving processes for engineering mechanics. Lectures will also emphasise the relationship of the content to engineering practice and will provide an opportunity for reflection on learning. You are strongly encouraged to attend the face-to-face lectures in Mathews Theatre A. The lectures are also live and recorded lectures should be available on the Moodle course page.

- **Workshops**

  Help you to further develop and consolidate problem solving skills. You will be encouraged, from time to time, to work in small groups to solve problems. The class problem sessions (workshops) ***are compulsory*** and begin in **Week 1** of term. We encourage you to develop a close working relationship with your demonstrators and the rest of your class.

- **Laboratory**

  Help you to learn how to implement the virtual reality experiments by using a structural analysis and design software SPACE GASS. You will install this software on your own PC and complete the relevant tasks given in the lab assignment.

- **Moodle Course Page**

  Provides a step-by-step guide to complete the course. There is a discussion forum to help provide interaction and help from your peers. Links to video recordings and Online Learning Modules to help you learn the solution techniques for many of the subject areas.

- **Pre-recorded Problem Solving Classes**

  Concentrate on developing strategies for solving problems in engineering mechanics. You are expected to watch the pre-recorded problem solving classes and attempt the problems prior to attending workshops.

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

In addition to the class problem sessions, you are expected to commit **at least 6 hours per week** to independent learning and general problem solving.

Suggested approaches to learning in this course include:

- Regular participation in lectures and workshop class problem sessions. *Review lecture and class problem material. Follow worked examples. Reflect on class problems and quizzes.*
- Complete all the required tasks in the Moodle course page for this course.

- 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.
- Students who perform poorly in the quizzes are strongly encouraged to discuss their progress with the lecturers during the term. 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

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

	Learning Outcome	**EA Stage 1 Competencies**
1.	Explain, describe and apply principles and components of Engineering Mechanics. Principles and components include: vectors, forces, torques, mass and inertia, particles and rigid bodies in two dimensions, equilibrium conditions, linear momentum and impact, kinetic and potential energy and internal forces and bending moments in beams	PE1.1, PE1.2, PE2.1
2.	Define engineering systems in a mechanically useful way and describe their equilibrium or motion in mathematical and graphical fashion and be able to relate this description to the principles of engineering mechanics	PE1.1, PE1.2, PE2.1
3.	Discern the relevant principles that must be applied to describe the equilibrium or motion of engineering systems and discriminate between relevant and irrelevant information in the context	PE1.2, PE2.1, PE2.2
4.	Demonstrate an ability to communicate clearly and precisely about technical matters related to Engineering Mechanics	PE3.2, PE3.5
5.	Accomplish hands on tasks that require the application of knowledge of Engineering Mechanics	PE2.1, PE2.2

COURSE PROGRAM

Term 2 2021

Date	Contents	Main Topics	Assessment (Sydney time)
31/05/2021 (Week 1)	Introduction; Vectors; Concurrent and non-concurrent forces; Forces; Moments and Couples	M1: Vectors and Forces M2: Moments and Couples	**9 Weekly Online Exercises** **7 best ones are counted** **Week 1 Exercise: M1**
07/06/2021 (Week 2)	Equilibrium; Types of Supports; Free Body Diagrams	M3: Equilibrium and Free Body Diagrams	**Week 2 Exercise: M1-M2**
15/06/2021 (Week 3)	Internal Actions; Beams; Axial Force Diagram; Shear Force Diagram; Bending Moment Diagram **No lecture on 14/06/2021 (public holiday)**	M4: AFD, SFD, BMD of Beams	**Week 3 Exercise: M1-M3**
21/06/2021 (Week 4)	Trusses; Method of Joints; Method of Sections	M5: Trusses	**Week 4 Exercise: M1-M4**
28/06/2021 (Week 5)	2D Frames; Structures with Internal Hinges; Friction; Fluid Statics	M6: Frames and Hinges M7: Friction and Fluid Statics	**Mid-term Quiz** – Friday 11am-12pm during Workshop (M1-M5) **Week 5 Exercise: M1-M5**
05/07/2021 (Week 6)	**No classes (lecture or workshop) and no weekly exercise this week**		
12/07/2021 (Week 7)	Geometric Section Properties of Plane Figures; Centroid; Second Moment of Area; Parallel Axis Theorem; Introduction to Dynamics	M8: Section Properties M9: Introduction to Dynamics and Kinematics of Particles	**Lab Assignment** due on Friday at 8pm **Week 7 Exercise: M8**
19/07/2021 (Week 8)	Kinematics of particles; Motion in One Dimension; Rectilinear Motion	M10: Kinetics of Particles	**Week 8 Exercise: M9**
26/07/2021 (Week 9)	Kinetics of Particles; Work and Energy	M11: Work and Energy for Particles	**Challenging Questions Assignment** due on Friday at 8pm **Week 9 Exercise: M9-M11**
02/08/2021 (Week 10)	Impulse and Momentum; Rigid Bodies	M12: Impulse, Momentum and Impact for Particles M13: Rigid Bodies	**Week 10 Exercise: M9-M12**
09/08/2021	Revision and Consultation (no workshop this week)		
Exam Period			**Final Exam: M1-M13** (exact date to be confirmed)

Please note the above schedule of Topics covered in each week is a guide only and subject to change based on time constraints. Please attend the lectures each week to ensure you are up to date with the content and know which material to revise prior to the upcoming class

ASSESSMENT

Assessment will be based on Weekly Online Exercises, Mid-term Quiz, Assignments and the Final Exam that will take place in the UNSW examination period. The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks.

9 Weekly Online Exercises (21%, marks of the 7 best ones are counted)

These exercises will keep you up-to-date with the course material. They will encourage you to practice some workshop problems on a weekly basis. Each exercise involves a set of calculation problems and is worthy of 3 marks. Only the final answer is submitted. **You have the chance to attempt the solution multiple times in order to receive a full mark of each exercise.** You are encouraged to collaborate with your peers in order to discover the solutions. The exercises open on each Monday and are due midnight on the following Monday. No late submissions allowed. **Marks of the 7 best ones will be counted in your final results and grade.**

Mid-term Quiz (12%)

The Open Book mid-term quiz will begin at ***11:00am (Sydney time) sharp*** during workshop in week 5. If you are late you do not receive additional time. **There will be no supplementary quiz**. **If you miss or cannot attend it, you can apply for special consideration, if successful, then 10% can be distributed to the final exam and 2% to the Challenging Questions Assignment.**

Lab Assignment (5%) and Challenging Questions Assignment (12%)

The lab assignment and challenging questions assignment are designed to let you do virtual reality lab experiments and do practice by solving a set of challenging problems, respectively. **Late work will be penalised at the rate of 10% per day after the submission deadline.**

Final Exam (50%)

The final exam is a **2hr Open Book examination**. Further information on how the Final Exam will be run (such as Online or in Campus) will be announced in due course. The exam covers all course content delivered during course. You will be assessed based on:

- Technical accuracy of calculations
- Evidence of good engineering practice including sketches, diagrams and correct use of units
- The entire solution procedure will be marked and not just the final answers.

You need to achieve at least 40% in the final exam in order to pass the course.

Other Important Information:

Supplementary Examinations for Term 2 2021 will be held on Monday 6th September – Friday 10th September 2021 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

ASSESSMENT OVERVIEW

Item	Length	Weighting	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
1. Weekly Exercises	9 Weekly Exercises and marks of the 7 best ones are counted	21% in total (3% each)	Continued learning Demonstrate understanding of concepts by applying problem solving and critical thinking	Midnight Monday of each relevant week. You can attempt multiple times to receive a full mark.	No late submissions	Immediately following due date
2. Mid-term Quiz	Designed for 50 minutes (allowed to complete within 60 minutes online including the time for uploading solutions)	12%	Solve problems and demonstrate good engineering practice in an exam environment	During second hour of the workshop in week 5: Friday 11am-12pm	N/A	Within 7 days
3. Assignments	a) Lab assignment: 3 weeks b) Challenging Questions assignment: 5 weeks	5% 12%	a) Implement virtual reality lab experiments b) solve problems and demonstrate good engineering practice	a) Week 7, 12pm on Friday b) Week 9, 12pm on Friday	7 days after the due date	Within 7 days
4. Final Exam	2 hours	50%	Demonstrate understanding of the total course content	Exam period: Date TBC	N/A	Release of final results

Note: You should achieve greater than 40% in the final exam in order to pass the course. The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School. The examinations and online problems show evidence of application of theoretical concepts to solving problems. There are no exemptions from any part of this assessment. If you are repeating the course, you must complete all components this year. Students who perform poorly in the exercises, mid-term quiz and assignments are recommended to discuss progress with the lecturer during the term.

PENALTIES

No late submissions allowed for the Weekly Exercises.

Late submission of the hand-in assignment without a valid Special Consideration will be penalised at the rate of 10% per day after the submission deadline.

RELEVANT RESOURCES

Textbooks:

- R.C. Hibbeler, "Engineering Mechanics: Statics" – 14th Edition in SI Units
- R.C. Hibbeler, "Engineering Mechanics: Dynamics" – 14th Edition in SI Units

Additional relevant materials:

- Bedford and Fowler, "Engineering Mechanics Statics", 8th Edition, Prentice Hall, 2008.
- Bedford and Fowler, "Engineering Mechanics Dynamics", 8th Edition, Prentice Hall, 2008.
- Hall, Archer, Gilbert, "Engineering Statics", 1999.
- Additional materials will be provided on Moodle

Pearson Mastering Engineering:

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

Moodle site may be accessed through: http://moodle.telt.unsw.edu.au

School's website: https://www.engineering.unsw.edu.au/civil-engineering/

School's student intranet: http://intranet.civeng.unsw.edu.au/student-intranet

DATES TO NOTE

Refer to MyUNSW for Important Dates available at: https://student.unsw.edu.au/dates

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

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership