MECH204

Mechanics of Solids

S2 Day 2018

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
Lecturer
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Monday, 2 to 4pm or make appointment via email

Credit points
3

Prerequisites
(ENGG150 or ENGG170 or ELEC170(P)) and (MATH133 or MATH136(P)) and ((PHYS106 and PHYS107) or (PHYS140(P) and PHYS143(P)))

Corequisites

Co-badged status

Unit description
This unit will examine free body diagrams. Stress-strain relations and elastic constants will be analysed in an engineering context. The unit will examine statically determinate stress systems,considering the impacts of direct stress, shear stress, bending stress, torsional stress in an engineering context. Bending moment diagrams, shear force diagrams and deflection of beams will be examined.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Demonstrate self-learning, time-management, and project management.

General Assessment Information

1. There will be no tutorial or practical in week 1. Please note that the practicals will only run on week 7 and week 8. Hence, students are not required to attend the practical sessions they enrolled in from week 1 to 6 and week 9 to 13. All students are however required to attend the tutorial every week except week 1.

2. Extension of assessment tasks will only be given for formal academic request that has been applied online.

3. In the event that an assessment task is submitted late, the following penalties will apply; 0 to 24 hours -25%, 24 hours to 48 hours -50%, greater than 48 hours will result in no mark being awarded.

4. Students are required to refer to Ilearn for detailed marking rubrics for each assessment tasks.

5. In order to pass this unit, a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD). For further details about grading, please refer below in the policies and procedures section. The unit will be graded according to the Macquarie University Grading policy. The following grades will be used according to the listed numerical range:

ASSESSMENT GRADES AND STATUS

GRADE	RANGE	STATUS ('Standard Grade' in AMIS)	DESCRIPTION
HD	85-100	Pass	Provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality, insight or creativity in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application as appropriate to the program.
D	75-84	Pass	Provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality or creativity in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the program and the audience.
CR	65-74	Pass	Provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; convincing argumentation with appropriate coherent justification; communication of ideas fluently and clearly in terms of the conventions of the program.
P	50-64	Pass	Provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the program; routine argumentation with acceptable justification; communication of information and ideas adequately in terms of the conventions of the program. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

F	0-49	Fail	Does not provide evidence of attainment of learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; missing, undeveloped, inappropriate or confusing argumentation; incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the program.

Assessment Tasks

Name	Weighting	Hurdle	Due
Diagnostic Quiz	5%	No	Week 2
Quiz	10%	No	Week 9
Assignment	10%	No	Week 9
Laboratory Reports	10%	No	Week 10
Participation and Logging	5%	No	Week 12
Final examination	60%	No	TBA

Diagnostic Quiz

Due: **Week 2**
Weighting: **5%**

The diagnostic quiz is a hurdle and hence, students are required to pass the quiz before the census date. Students who fail this quiz may consider disenrolling themselves before the census date to avoid penalty. This quiz consists of basic background information that students are expected to know before they continue with this unit. In this quiz, students are expected to show accurate solutions of force analysis on structures and machines. All the solution steps including the free body diagram must be shown clearly.

On successful completion you will be able to:

- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.

Quiz

Due: **Week 9**
Weighting: **10%**

The quiz will include topics covered from lecture 1 to lecture 8. Accurate numerical solutions of the problems are required and all solution steps must be shown clearly. Students are also expected to derive common formulas used to solve basic mechanics related problems and demonstrate understanding of the fundamental assumptions made in the formulas.

On successful completion you will be able to:

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Assignment

Due: **Week 9**
Weighting: **10%**

This assignment must be typed and submitted online with a cover sheet. The maximum number of pages in the assignment report is ten. There is an element of design in this assignment and hence, it is unlikely that students will generate the same solutions or reports that look similar. Academic misconduct related to plagiarism will incur academic penalty. Students should not discuss solutions of this assignment with one another.

On successful completion you will be able to:

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.
- Demonstrate self-learning, time-management, and project management.

Laboratory Reports

Due: **Week 10**
Weighting: **10%**

There will be two laboratory tasks in this unit and the attendance is compulsory. The laboratory report must be typed and must include both the laboratory tasks. The maximum number of pages in the report is ten. Students must use the laboratory report template provided on ILEARN. Laboratory report must be submitted online with a cover sheet.

On successful completion you will be able to:

- Demonstrate self-learning, time-management, and project management.

Participation and Logging

Due: **Week 12**

Weighting: **5%**

Attendance will only be given to students who attempt all the tutorial questions. Students are strongly encouraged to attempt the tutorial questions before they turn up for the tutorial but all tutorial solutions must be re-attempted and presented neatly in class. Students are required to sit through the entire tutorial session to get their attendance marked. Each student must have a bounded notebook to be used as a laboratory/ tutorial logbook. On the completion of each tutorial session, log book must be signed and dated by a tutor. Marks for the logbook at the end of tutorial sessions (week 2 to week 12) will be given.

On successful completion you will be able to:

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.
- Demonstrate self-learning, time-management, and project management.

Final examination

Due: **TBA**
Weighting: **60%**

There will be three to four questions in the final exam. Duration given for the exam will be at least 2 hours. Accurate numerical solutions of the problems are required and all solution steps must be shown clearly. Students are also expected to derive common formulas used to solve basic mechanics related problems and demonstrate understanding of the fundamental assumptions made in the formulas.

On successful completion you will be able to:

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Delivery and Resources

Russell C Hibbeler, Statics and Mechanics of Materials in SI Units (5th Edition, Pearson).

The purchased of this textbook is strongly encouraged. The textbook which is supplemented by

an online training module contained additional exercises to help students practice mechanics problems taught in the unit.

Other required resources: scientific calculators, log books.

Unit Schedule

Weeks	Lecture Topic	Assignments during tutorials
1.	Introduction to Mechanics of Solids	
2.	Centroid and Moment of Inertia	Introduction of Mechanics of Solids
3.	Mechanical Stress and Strain	Centroid and Moment of Inertia
4.	Mechanical Properties of Material	Mechanical Stress and Strain
5.	Axially Loaded Member	Mechanical Properties of Material
6.	Torsion	Axially Loaded Member
7.	Shear Force and Bending Moment Diagrams	Torsion and Laboratory experiment
8.	Bending Stress and Transverse Shear Stress	Shear Force and Bending Moment and Laboratory experiment
9.	Quiz. Week 1 – 8 learning content	Shear Force and Bending Moment Diagrams – Non-Uniform Distributed Loads
10.	Plane Stress Transformation	Bending Stress and Transverse Shear
11.	Plane Strain Transformation	Plane Stress Transformation
12.	Beams Deflection and Columns	Plane Strain Transformation
13.	Columns and Summary of learning content	Beams Deflection and Columns

Refer to iLearn and lecture notes for more details.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy

- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Assessment task

- Assignment

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- Demonstrate self-learning, time-management, and project management.

Assessment tasks

- Assignment
- Laboratory Reports
- Participation and Logging

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Demonstrate self-learning, time-management, and project management.

Assessment task

- Participation and Logging

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.

Assessment tasks

- Diagnostic Quiz
- Quiz
- Final examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to

have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Ability to explain and demonstrate understanding on the mechanical properties of materials and identify different modes of mechanical failures in machines and structures.
- Ability to analyse and determine forces and stresses in two and three-dimensional structures accurately.
- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Assessment tasks

- Quiz
- Laboratory Reports
- Final examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcome

- Ability to apply the concept of force and stress analysis in mechanical engineering design and in real world engineering problems.

Assessment tasks

- Assignment
- Final examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- Demonstrate self-learning, time-management, and project management.

Assessment tasks

- Assignment
- Laboratory Reports
- Participation and Logging

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- Demonstrate self-learning, time-management, and project management.

Assessment task

- Assignment

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- Demonstrate self-learning, time-management, and project management.

Assessment task

- Assignment

Changes from Previous Offering

1. Change of textbook from RC Hibbeler, Mechanics of Materials (11th edition) to RC Hibbeler, Statics and Mechanics of Materials in SI Units, Global Edition with Mastering in Engineering. The interactive, self-paced tutorials in the textbook which the convenor has been formally invited to review and develop provide individualized coaching to help students stay on track. With a wide

range of activities available, students can actively learn, understand, and retain even the most difficult concepts. The text and Mastering Engineering work together to guide students through engineering concepts with a multi-step approach to problems and will provide students with plenty of practice examples to improve results.

Changes in Response to Student Feedback

2. Remedial lessons will be provided for students who fail the diagnostic quiz. To help students appreciate the expectations of the solutions presented in quiz and exam, examples of good and poor solutions will be presented in lecture 1 and throughout the semester.