Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	
Semester/Trimester/Others (specify approx. Start/End date)	
Course Author * Faculty proposing/revising the course	Lee-Chua Lee Hong
Course Author Email	clhlee@ntu.edu.sg
Course Title	Mechanics of Materials
Course Code	CV1011
Academic Units	3
Contact Hours	52
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to equip you with the basic knowledge of:

1. forces and stress/strain in simple structures under static equilibrium

2. stress/strain for members under axial, bending, shear, torsion and their combination

3. column buckling

The topics covered in this course provide essential technical basis for the analysis and design of civil structures.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Determine forces and their resultants in static equilibrium in 1D, 2D and 3D situations, using scalar and vector approaches
ILO 2	Determine the forces in a simple structure under external loads; and present them in appropriate form
ILO 3	Determine the geometric properties of shapes in elementary and composite forms and apply to the context of distributed loads and section properties
ILO 4	Recall the basic mechanical properties of materials
ILO 5	Determine the stress and strain in a member under axial load, torsion, bending, shear and their combination; and their relevance to design
ILO 6	Transform plane stress (strain) components from one orientation to another, and determine their principal/maximum values
ILO 7	Determine the buckling load of simple columns

Course Content

S/N	Topic	Lecture Hrs	Tutorial Hrs
1	Forces and vectors	2	1
2	System of forces and resultants	2	
3	Equilibrium of a body	2	1
4	Geometric properties and distributed loads	3	1
5	Internal forces	3	1
6	Stress and strain	2	
7	Mechanical properties of materials	2	1
8	Axially loaded members	2	1
9	Torsion	3	1
10	Bending stress in beams	3	1
11	Shear stress in beams	3	1
12	Combined stresses	2	1
13	Stress (strain) transformation	6	2
14	Column buckling	4	1
	Total:	39	13

Reading and References (if applicable)

1. Hibbeler, R.C., Statics and Mechanics of Materials, SI Edition, Pearson – Prentice Hall, 2004.

2. Gere, J.M., Timoshenko, S.P., Mechanics of Materials, Stanley Thornes, 1999.

3. Beer, F.P., Johnston, E.R., Mechanics of Materials, McGraw-Hill, 2015.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction, force and moment, couple, equivalent system, static equilibrium, free body diagram, basic member types	1, 2		In-person	Lectures & Tutorial
2	Centroid of a system of particles and continuum, elementary and composite bodies, resultant of distributed force, moment of area of basic and composite shapes, parallel axis theorem	3		In-person	Lectures & Tutorial
3	Internal forces in structures, shear and bending moment diagram, relationship between load, shear and bending moment	1, 2		In-person	Lectures & Tutorial

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
4	Vector approach, vector addition of forces, position vectors, dot product, cross product, moment about an axis	1, 2		In-person	Lectures & Tutorial
5	Stress in average and local sense, axial stress, shear stress, allowable stress, design of simple connections, deformation and strain	4, 5		In-person	Lectures & Tutorial
6	Tension and compression test, stress-strain diagram, stress-strain behaviour of ductile and brittle materials, Hooke's law, strain energy	4, 5		In-person	Lectures & Tutorial
7	Poisson's ratio, shear stress-strain diagram Axially loaded members, principle of superposition, statistically indeterminate axially loaded members, thermal stress	4, 5		In-person	Lectures & Tutorial

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
8	Circular shaft under torsion, shear stress and twist angle	5		In-person	Lectures & Tutorial
9	Normal stress in beams under bending, curvature	5		In-person	Lectures & Tutorial
10	Shear stress in beams under bending, wide-flange sections	5		In-person	Lectures & Tutorial
11	Combined stresses & Stress transformation, introduction	5, 6		In-person	Lectures & Tutorial
12	Principal stress, maximum shear, Mohr circle	6		In-person	Lectures & Tutorial
13	Buckling behaviour, Euler's equation, critical load	7		In-person	Lectures & Tutorial

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Weekly lectures provide students with specific knowledge and techniques to achieve learning outcomes
Tutorials	Weekly tutorials enable students to apply the knowledge to solve structured problems. Students are encouraged to explore alternative approaches and techniques

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Summative Assessment (EXAM): Final exam(Final Examination)	All	EAB SLOs (a), (b)	60	Individual	Holistic	Relational
2	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 1 : Quiz 1)	1 to 7	EAB SLOs (a), (b)	20	Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 2 : Quiz 2)	8 to 14	EAB SLOs (a), (b)	20	Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

*CEE SLOs = Student Learning Outcome For Civil Engineering Programme (Per BEng Civil Engineering Accreditation)

Related Programme LO or Graduate Attributes

a. Engineering knowledge: Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems;

b. Problem Analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences;

c. Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

d. Investigation: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.

h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. Life-long Learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Formative Feedback

1. Feedback will be through the dissemination of your performance in quiz and review of quiz questions in class/tutorial.

2. You are encouraged to discuss questions during or outside lectures and tutorials based on individual needs.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Problem Solving	Basic

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

The standing university policy governing student responsibilities shall apply.
No special policy for this course.

Policy (Absenteeism)

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Policy (Others, if applicable)

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