COURSE CONTENT

Academic Year	2023-2024	**Semester**	2
Course Coordinator			
Course Code	CV2011		
Course Title	Structural Analysis 1		
Pre-requisites	CV1011 Mechanics of Materials		
No of AUs	3		
Contact Hours	Total: 39 Hours (Lecture: 26 hours; Tutorial: 13 hours)		
Proposal Date	12 September 2023		

Course Aims

This course aims to:

i) Provide you with the knowledge of the fundamental principles structural analysis;
ii) Equip you with basic understanding of the theory and application of structural analysis trusses, beams and frames

Course Learning Outcomes (Course LO)

On successful completion of the course, You should be able to

1. Differentiate between real structures and idealized systems, and the distribution of forces on structural systems.
2. Describe and explain concepts of loading, boundary condition, and equilibrium of systems in structural analysis
3. Identify and determine the physical response of structures to loading and the effect this has on the response.
4. Perform basic calculations to determine internal forces of truss structures and appreciate the importance of structural analysis in the design of practical structures.
5. Perform basic calculations to determine internal forces of frame structures and appreciate the importance of structural analysis in the design of practical structures.
6. Perform basic calculations to determine deflections of simple beam and frame structures
7. Perform basic calculations to determine deflections of simple truss structures

Course Content

S/N	Topic	Lecture Hrs	Tutorial Hrs
1	Structural forms and classifications. Loads. Structural analysis and design.	2	1
2	Idealized structures. Principle of superposition. Equations of equilibrium, Internal forces, Free body diagrams.	1	1

3	Structural stability, Stability evaluation through nominal degree of freedom; Static determinacy, Static aspects of structures	2	1
4	Introduction to planar trusses, Stability and determinacy of trusses,	2	1
5	Analysis of planar trusses	2	1
6	Analysis of simple beams	2	1
7	Analysis of simple frames	2	1
8	Deflections of beams: The double integrating method	3	1
9	Deflections of beams: Moment-Area Method	1	1
10	Deflections of beams: Moment-Area Method	2	1
11	Deflections of beams: energy methods: Principle of Work and Energy, Principle of Virtual Work (PVW)	3	1
12	Deflections of trusses: Principle of Virtual Work (PVW)	2	1
13	Deflections using energy methods: Other Types of Virtual Strain Energy	2	1
	Total:	26	13

Assessment

Components	**Course LO tested**	**Related programme SLO or graduate attributes**	**weighting**	**Team/ Individual**	**Assessment rubrics**
1. Final Examination	All	EAB SLOs (a),(b),(c), (e)	60%	Individual	
2. Continuous Assessment 1: Quiz 1	1, 2, 3, 4	EAB SLOs (a), (b),(c)	20%	Individual	
3. Continuous Assessment 2: Quiz 2	5, 6	EAB SLOs (a), (b), (c)	20%	Individual	
Total			100%		

*CEE SLOs = Student Learning Outcome For Civil Engineering Progamme (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 the student's performance in quizzes as well as review of the quiz questions in class.
2. We encourage you to initiate an Individual consultation sessions on your particular learning needs.

Learning and Teaching approach

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

Textbooks/References:

1. R.C. Hibbeler, "Structural Analysis". Pearson Prentice-Hall, 9th Edition, 2014.
2. H, West, Harry; L.F. Geschwinder "Fundamentals of structural analysis" Wiley, 2nd ed. 2002.
3. J.M. Gere, "Mechanics of Materials". Thomson Brooks/Cole, 6th Edition, 2004

Course Policies and Student Responsibilities

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

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. 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 If you are uncertain of the definitions of any of these terms, you should go to the Academic Integrity Handbook for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors AY2019/20

Instructor	Office Location	Phone	Email

Planned Weekly Schedule

Week	Topics	Course LO	Activities
1	Scope of the course. Introduction. Structural forms and classifications. Loads. Structural analysis and design.	1	Lectures & Tutorial
2	Idealized structures. Principle of superposition. Equations of equilibrium, Internal forces, Free body diagrams. Structural stability, Stability evaluation through nominal degree of freedom; Static determinacy, Static aspects of structures	2	Lectures & Tutorial
3	Introduction to planar trusses, Stability and determinacy of trusses, Analysis of planar trusses I	3	Lectures & Tutorial
4	Analysis of planar trusses II Analysis of simple beam I: internal forces and their sign convention	3, 4	Lectures & Tutorial
5	Analysis of simple beam II: shear force and bending moment functions	4, 5	Lectures & Tutorial
6	Analysis of simple frame I: shear force and bending moment diagrams	5	Lectures & Tutorial
7	Analysis of simple frame II: shear force and bending moment diagrams	5	Lectures & Tutorial
8	Deflections of beams: Deflection Diagrams and Elastic Curves	6	Lectures & Tutorial
9	Deflections of beams: The double integration method; Macaulay's Method	6	Lectures & Tutorial
10	Deflections of beams: Moment-Area Method (theorems)	6	Lectures & Tutorial
11	Deflections using energy methods: Principle of Work and Energy, Principle of Virtual Work (PVW)	6	Lectures & Tutorial
12	Deflections using energy methods: Deflections of truss by PVW, Deflections of Beams by PVW	6,7	Lectures & Tutorial
13	Deflections using energy methods: Deflections of Frames by PVW; Other Types of Virtual Strain Energy	6,7	Lectures & Tutorial