COURSE CONTENT

Academic Year	2023-24	**Semester**	2
Course Coordinator			
Course Code	CV2012		
Course Title	Structural Analysis II		
Pre-requisites	CV2011 Structural Analysis I		
No of AUs	3		
Contact Hours	Lecture: 26 hrs; Tutorial: 13 hrs;		
Proposal Date	12 September 23		

Course Aims

This course aims to develop in you a deeper understanding and greater proficiency in structural analysis using Influence Lines, Force Method, Slope Deflection Method and Stiffness Matrix Method.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. Construct Influence Lines using equilibrium method and Muller-Breslau method for beams and floor girders, and apply them to determine effects due to series of moving point loads.
2. Use Force Method to analyse statically indeterminate structures such as trusses, frames and composite structures, with effects of support settlements / elastic supports.
3. Use Slope Deflection method to analyse statically indeterminate structures such as continuous beams and frames, without sway and with sway, and with effects of support settlements / elastic supports.
4. Use Stiffness matrix method to determine the displacements and reactions of statically indeterminate structures such as continuous beams and frames.

Course Content

S/N	Topic	Lecture Hours	Tutorial Hours
1	Influence line by equilibrium method and Muller-Breslau method. Influence line for beams and floor girders. Applications of influence line.	5	2
2	General procedure of force method for trusses, frames and composite structures. Effect of support settlements and beams on elastic supports	7	4
3	Application of Slope Deflection method to beams and frames, without sway and with sway, and with effects of support settlements/elastic supports.	6	3

4	Application of Stiffness matrix method to determine the displacements and reactions of statically indeterminate structures such as continuous beams and frames.	8	4
	Total hours	**26**	**13**

Assessment (includes both continuous and summative assessment)

Component	**Course LO Tested**	**Related Programme LO or Graduate Attributes**	**Weighting**	**Team/ Individual**	**Assessment rubrics**
1. Final Examination	1, 2, 3, 4	CEE SLOs a, b	60%	Individual	
2. Continuous Assessment 1 (CA1): Quiz	1,2	CEE SLOs a, b	20%	Individual	
3. Continuous Assessment 2 (CA2): Quiz	3,4	CEE SLOs a, b	20%	Individual	
Total			100%		

*CEE SLOs = Student Learning Outcome For Civil Engineering Progamme (Per Beng Civil Engineering Accreditation)

CEE SLOs (2018)

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

Feedback will be through the dissemination of the student's performance in quizzes as well as review of the quiz questions in class.
Instructors encourage students to ask questions during or outside the tutorials and lectures.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Lectures	Present the basic theory, problem solving process, and problem based procedure.
Tutorials	Provide examples and discussions, to illustrate detailed problem solving process.

Reading and References

Textbooks

1. **Structural Analysis**, by R.C. Hibbeler, 9th Ed. or 10th Ed., Pearson.

References

1. **Fundamentals of Structural Analysis**, by Leet, Uang and Gilbert, 3rd Ed. or 4th Ed., McGraw Hill.

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

Instructor	Office Location	Phone	Email

Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Dead load and live load. Introduction to influence lines. Influence line by equilibrium methods.	1	Lectures & Tutorial
2	Influence line by Muller-Breslau principle. Influence line for floor girders. Application of influence line.	1	Lectures & Tutorial
3	Effect due to series of point loads. Revision of virtual work method	1/2	Lectures & Tutorial
4	Statically indeterminate structures General procedure of force method. Worked examples	2	Lectures & Tutorial
5	Effect of support settlements Beams on elastic supports	2	Lectures & Tutorial
6	Frames, trusses and composite structures Review	2	Lectures & Tutorial

7	Slope-deflection equations. Degree of kinematic indeterminacy. Equilibrium and compatibility condition. Slope-deflection equations. Worked examples.	3	Lectures & Tutorial
8	Application of slope-deflection method to beam and frame problems without sway.	3	Lectures & Tutorial
9	Application of slope-deflection method to beam and frame problems with sway. Worked examples.	3	Lectures & Tutorial
10	Introduction to stiffness matrix method.	4	Lectures & Tutorial
11	Beam-member stiffness matrix. Assembly of structure stiffness matrix.	4	Lectures & Tutorial
12	Application of stiffness matrix method for beam analysis. Frame-member stiffness matrix.	4	Lectures & Tutorial
13	Transformation matrix and global stiffness matrix. Application of Stiffness matrix method for plane frame analysis.	4	Lectures & Tutorial