COURSE CONTENT

Academic Year	2020/21	**Semester**	I
Course Coordinator	Zhao Zhiye		
Course Code	CV4101		
Course Title	Structural Analysis III		
Pre-requisites	CV2012 Structural Analysis II		
No of AUs	3		
Contact Hours	Lecture: 26 hrs; Tutorial: 13 hrs;		
Proposal Date	31 August 2020		

Course Aims

This course aims to equip students with theory and applications of matrix analysis for structures and theory and method for stability analysis of structures.

Intended Learning Outcomes (ILO)

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

1. Evaluate degrees of freedom for truss, beam, and frame structures.
2. Construct member stiffness matrix and force vectors in both local and global coordinates for truss, beam, and frame structures.
3. Assemble the member stiffness matrix and apply boundary conditions.
4. Analyse low degrees of freedom structure by hand calculation.
5. Apply unit displacement method to solve truss, beam and frame structures.
6. Analyse stability of simple struts using differential equation approach.
7. Analyse stability of frame structures using matrix approach.
8. Solve complex truss/beam/frame structures by a computer software.

Course Content

S/N	Topic	Lecture Hours	Tutorial Hours
1	Introduction to matrix method and degrees of freedom	1	1
2	Analysis of trusses	4	2
3	Analysis of beams	4	2
4	Analysis of frames	4	1
5	Unit displacement method	3	2
6	Elastic stability analysis of simple struts	4	2
7	Elastic stability analysis of frames	4	2
8	Computer modelling of 2D/3D truss/beam/frame structures	2	1
	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, 4,5,6,7	CEE SLOs a, b	60%	Individual	
2. Continuous Assessment 1 (CA1): Quiz	1,2,3,4, 8	CEE SLOs a, b, e	20%	Individual	
2. Continuous Assessment 2 (CA1): Quiz	5,6,7	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 civil engineering specialisation to the solution of complex civil engineering problems.

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

c) Design/development of Solutions: Design solutions for complex civil engineering problems and design system components or processes 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 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 civil 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 the need for the sustainable development.

h) Ethics: Apply ethical principles and commit to professional and moral responsibilities in the civil 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 civil engineering activities with the engineering community and with society at large, be able to comprehend and write effective reports and design documentation, and make effective presentations.

k) Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to work, as a member and leader in a multidisciplinary team.

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 evolution.

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. Instructors encourage students to ask questions during 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.
Computer hands-on session	Apply software to model complex structures.

Reading and References

Textbooks

1. McGuire, W., Gallagher, R.H. and Ziemian, R.D., "Matrix Structural Analysis". 2nd edition, John Wiley and Sons, 2000.

2. Simitses, G.J. and Hodges, D.H., "Fundamentals of Structural Stability." Elsevier, New York, 2006.

References

1. Kassimali, A. "Matrix Analysis of Structures". Cengage Learning, 2012

3. Chen, W.F. and Lui, E.M. "Structural Stability: Theory Implementation". Elsevier, 1987.

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. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website 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
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Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Introduction to the course, DOF, equation solving using Excel, truss modelling using stiffness method and computer software.	1	Lectures & Tutorial
2	Truss stiffness matrix in local and global coordinates. Stiffness assembly, boundary conditions, stiffness method equation solving	2,3,4	Lectures & Tutorial
3	Special boundary conditions: spring support and inclined roller. Beam stiffness matrix and equation solving.	2,3,4,8	Lectures & Lab
4	Beam under member forces Beam using modified stiffness matrix	2,3,4	Lectures & Tutorial
5	Special boundary conditions: spring support and settlement. Introduction to frame stiffness matrix, relationship between truss, beam and frame.	2,3,4	Lectures & Tutorial
6	Frame under member force Frame using modified stiffness matrix	2,3,4	Lectures & Tutorial
7	Computer application (Lab) Computer application (Lab)	8	Tutorial & Lab
8	Unit displacement method	5	Lectures & Tutorial
9	Introduction of space frames, global stiffness matrix, examples Introduction of elastic stability; Euler bucking load	6	Lectures & Tutorial
10	Simple struts; effective length Differential equation method for columns in frame	6	Lectures & Tutorial
11	Stability effects on beam-columns, Stability functions (*s, c* functions) Discussion of *s,c* functions, Stiffness matrix incorporating *s,c*.	6	Lectures & Tutorial
12	Computing critical load using matrix approach, Elastic stability of plane frames.	7	Lectures & Tutorial
13	Computing critical load using matrix approach, Elastic stability of plane frames. Summary	7	Lectures & Tutorial

Note: Lab refers to computer lab for truss/beam/frame modelling using a software.