NANYANG TECHNOLOGICAL UNIVERSITY

COURSE CONTENT

Academic Year	2018-2019	**Semester**	I
Course Coordinator	Soh Chee Kiong		
Course Code	CV4102		
Course Title	Advanced Steel Design		
Pre-requisites	CV3012 Steel Design		
No of AUs	3.0		
Contact Hours	Lectures: 26 hrs; Tutorials: 13 hrs; Lab: 0 hr		
Proposal Date	7 Dec 2018		

Course Aims

To develop deeper understanding and greater capability in structural steelwork design based on limit state principles. The materials covered in the course enable you to familiarize with EC3 and essential part of EC4 for the design of steel structures in practice.

Intended Learning Outcomes (ILO)

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

1. Analyze and design moment connections to EC3, and composite design of beams and slabs in accordance with EC4.
2. Perform plastic analysis and design of steel beams, and rectangular and portal frames.
3. Apply elastic and plastic design to multi-storey rigid frames, with distinction between sway frames and non-sway frames.
4. Perform complete design of single-storey building integrating the design of various members and frames.
5. Analyze and design complete plate girder in accordance with EC3.
6. Incorporate buildability, serviceability and maintainability plans in the design.

Course Content

S/N	Topic	Lecture Hours	Tutorial Hours
1	Behavior and design of circular and rectangular hollow sections	4	2
2	Behavior and design of bolted and welded moment connections	4	2
3	Behavior and design of multi-storey rigid frames	5	3
4	Behavior and design of plate girders	7	4
5	Plastic analysis and design of beams, and rectangular and portal frames	6	2

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 (Open Book Exam)	1-6	a, b, c, d, g,	60%	Individual	
2. Continuous Assessment 1 (CA1): Assignment – Design of Grandstand Stadium Roof	1-4	a, b, c, d, e, g, j, l	20%	Individual	Appendix 1
3. Continuous Assessment 2 (CA2): Assignment – Design of 3-span Plate Girder	5-6	a, b, c, d, e, g, j, l	20%	Individual	Appendix 1
Total			100%		

* EAB SLO stands for the Engineering Accreditation Board Student Learning Outcomes. The list is below:

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 primarily be through discussions when you embark on your two design

assignments.
2. Additional discussions during tutorials and through consultations initiated by you 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 enable you to have the necessary knowledge to achieve the learning outcomes
Tutorials	Weekly tutorials to get you to practice and hone your ability to achieve the learning outcomes
Assignments	Discussions and consultations initiated by you on your needs to perform and achieve the learning outcomes

Reading and References

Reading

1. Darko Beg et. al. "Design of Plated Structures Eurocode 3: Design of steel structures: Part 1-5- Design of plated structures", ECCS and Ernst & Sohn, 2010. Available as e-Book at NTU library [TA684.DA457sf].
2. Wardenier, J. "Hollow Sections in Structural Applications" Bouwen met Staal, 2002 (free download at http://www.cidect.com).

References

1. Trahair NS et. al. "The Behavior and Design of Steel Structures to EC3", 4th edition, Taylor and Francis, 2007 [TA684.T765 2008].
2. Leroy Gardner and David A. Nethercot "Designer's guide to Eurocode 3: Design of Steel Building, EN1993-1-1, 1-3 and 1-8 Available as e-Book at NTU library: XX (792751.2).
3. Packer, J.A., Sherman, D. and Lecce, M., "New Design Guide for Hollow Structural Section Connections", American Institute of Steel Construction, 2010 [TA 684.P119 2010].

Course Policies and Student Responsibilities

As a student of the course, you are required to abide by both the University Code of Conduct and the Student Code of Conduct. The Codes provide information on the responsibilities of all NTU students, as well as examples of misconduct and details about how students can report suspected misconduct. The university also has the Student Mental Health Policy. The Policy states the University's commitment to providing a supportive environment for the holistic development of students, including the improvement of your mental health and wellbeing. These policies and codes concerning students can be found in the following link.

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
Soh Chee Kiong	CEE N1-1c-71	6790-5278	csohck@ntu.edu.sg
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Planned Weekly Schedule

Week	Topic	Course LO	Readings/Activities
1	Behavior and design of circular hollow sections	1,6	Lectures/ Tutorials
2	Behavior and design of rectangular hollow sections	1,6	Lectures/ Tutorials
3	Behavior and design of moment connections	1	Lectures/ Tutorials
4	Behavior and design of bolted and welded connections	1	Lectures/ Tutorials
5	Behavior and design of multi-storey rigid frames	3	Lectures/ Tutorials
6	Approximate analysis, stability and P-Delta effect of frames	3	Lectures/ Tutorials
7	Consultation for 1st design assignment. Behaviours and actions of plate girders	5	Lectures/ Tutorials
8	Resistance to bending and shear of plate girders	5	Lectures/ Tutorials
9	Design of stiffener and end post	5	Lectures/ Tutorials
10	Complete design of plate girders Consultation for 2nd design assignment	5, 6	Lectures/ Tutorials
11	Plastic analysis and plastic hinge	2	Lectures/ Tutorials
12	Theorems of plastic analysis Plastic analysis of rectangular frames	2, 4	Lectures/ Tutorials
13	Plastic analysis of portal frames and ICR	4, 6	Lectures/ Tutorials

Appendix 1: Assessment Criteria for Design Assignments 1 and 2

Performance Level/Criteria					
Weighting	**Performance Indicators**	**Outstanding: 4**	**Good: 3**	**Average, meet expectation: 2**	**Below expectations: 1**
Technical Knowledge (70%)	***Identify appropriate design factors, parameters and apply design code***	Correct design factors and parameters used in design	Some inaccurate design factors and parameters used in design	Some incorrect design factors and parameters used in design	Many incorrect design factors and parameters used in design
	Apply correct design principles and methodology	Correct principles and methodology applied in design	some incorrect principles and methodology applied in design	Many incorrect principles and methodology applied in design	Design based on incorrect principles and methodology
Creativity and Innovativeness (20%)	***Propose cost-effective designs which meet client requirements***	Design is cost effective, meets client requirements, creative and innovative	Design is generally cost effective and meets client requirements	Design is lacking in cost effectiveness and in meeting client requirements	Design is not cost effective and does not meet client requirements
	Consider socio-economic and buildability in design	Design pays much attention to socio-economic and environmental sustainability	Design pays sufficient attention to socio-economic and environmental sustainability	Design pays little attention to socio-economic and environmental sustainability	No consideration for socio-economic and environmental sustainability in design
	Consider practicality of project implementation	Proposed design can be readily and practically implemented	Proposed design can be implemented with some challenges	Proposed design can be implemented with great difficulties	Proposed design cannot be implemented
Technical Communication (10%)	***Technical Drawing***	The technical drawing communicates the design details and concepts clearly and professionally	The technical drawing has the design details and concepts. There are several minor mistakes in the drawing which affects the clarity.	The technical drawing has the main design details and concepts and is comprehensible. However, there are quite a number of mistakes in the drawing.	There was no technical drawing OR that the technical drawing is unintelligible or plagiarised

Related Programme LO or Graduate Attributes

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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.

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