COURSE CONTENT

Academic Year	2023-24	**Semester**	2
Course Coordinator			
Course Code	CV4912		
Course Title	Integrated Design Project		
Pre-requisites	Year 4 standing		
No of AUs	3		
Contact Hours	Lecture: 13 hrs; Tutorial: 0 hr; Project Design: 26hrs		
Proposal Date	12 September 2023		

Course Aims

The objective of this course is to give students an opportunity to carry out Civil Engineering Design project from conception to completion, involving different disciplines such as architectural, reinforced concrete/steel design, foundation & geotechnical design to construction management.

Students will have opportunity to work as a team and participate in one of the role in this design process, create the project in 3D model, using Building Information management (BIM) tools and propose sustainable solutions in the project.

After successfully attending the course, students should have a better appreciation on how to execute a design project with contributions from team members that specialised in different tasks.

Intended Learning Outcomes (ILO)

At the end of the course, student would be able to,

1. Collaborate with peers from various disciplines to carry out a civil engineering design project.
2. Identify critical tasks in the process of conception of design to completion of civil engineering design project.
3. Apply appropriate design principles and methodology for a civil engineering project.
4. Integrate different components of civil engineering design.
5. Consider practicality of project during design process.
6. Incorporate various relevant design requirements, i.e. statutory, owners, codes and standards and recommended design guides in the civil engineering design project.

The design would include basic architectural design of buildings, design of reinforced concrete structures, steel structures and foundation as well as basic project management and construction methodology.

Course Content

This is a project-based course in which students are required to undertake a group project covering both the conceptual and detailed aspects of design and planning. The project could involve different areas of the civil engineering disciplines such as ground investigation, planning, architectural design, economic evaluation and Building Information Management (BIM), foundation design, structural design, and buildability of the construction.

S/N	Topic	Lecture Hrs	Project Design Hrs
1.	Course overview and project briefing	1	2
2.	Building Information Management (BIM)	2	2
3.	Architectural design	2	2
4.	Reinforced concrete design and steel design	4	10
5.	Foundation design	2	5
6.	Project /Construction management	2	5
	Total	13	26

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment rubrics
1. Minutes of Meeting & Task List	1, 2, 3	a, e, i, j,	15% x MF*	Team	Appendix 1
2. Progress report	1, 2, 3, 4, 5	a, b, c, d, e, i, j, k.	25% x MF*	Team	Appendix 3
3. Presentation	1, 3, 4, 5, 6	a, b, c, d, e, g, i, j, k.	20 %	Team	Appendix 2
4. Group Final Reports	1, 2, 3, 4, 5, 6	a, b, c, d, e, g, i, j, k.	40% x MF*	Team	Appendix 3
Total			100%		

*Notes *: The assessment for this course is heavily reliant on you working closely as a team to complete the civil engineering project. In order to account for your Individual Contribution to the team, the Modification Factor (MF) will be applied to account for your individual contribution to the project work. The MF is derived from panel judges' feedback, minutes of meetings and peer assessment. For more details on the MF calculation, please see Appendix 4.*

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

Conduct regular review and feedback through Project Design Consultations.

You are encouraged to meet Instructors to seek feedback on your project design reports.

The progress report and final project grades are announced to students.

Learning and Teaching approach

After formal lectures during the first 3 weeks, you meet your task instructor once per week over 2 hours for consultations and give a short presentation in the final week.

Approach	**How does this approach support students in achieving the learning outcomes?**
Lectures	Formal lectures on principles related to the design projects
Consultations	You will have the opportunity to consult with panel judges to clarify on the concepts taught during lectures and guidance in completing the design projects
Group Design Reports	You learn to work as a team to complete the design project reports which require self-study and research and team work beyond the lecture materials

Reading and References

Building Information Modelling (BIM) Aspects:

1. Singapore BIM Guide, Version 2, BCA, 2013.
2. Singapore VDC Guide, Version 1.0, BCA, 2017.
3. Karen, K. and Douglas, N., "Building Information Modelling: BIM in Current and Future Practice", 1st edition, John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2014.

Structural (RC and Steel Design) Aspects:

1. Mosley, W.H., Bungey, J.H., and Hulse, R., "Reinforced Concrete Design to Eurocode 2", 7th edition, Palgrave Macmillan, London, UK, 2012.
2. Lam, D., Ang, T.C. and Chiew, S.P., "Structural Steelwork: Design to Limit State Theory", 4th edition, CRC Press, Taylor & Francis Group, London, UK, 2014.
3. Gardner, L. and Nethercot, D.A., "Designers' Guide to Eurocode 3: Design of Steel Structures – Designers' Guide to EN 1993-1-1 Eurocode 3: Design of Steel Structures General Rules and Rules for Buildings", Thomas Telford, London, UK, 2005.
4. Draycott, T. and Bullman, P., "Structural Elements Design Manual: Working with Eurocodes", 2nd edition, Butterworth-Heinemann, Oxford, UK, 2009.

Construction Aspects:

1. A Guide to the Project Management Body of Knowledge (Pmbok Guide) - 5th edition, Project Management Institute Inc., 2013.

Geotechnical Aspects:

1. Coduto, D.P., **"Foundation Design – Principles and Practices", 2nd edition,** Prentice Hall, 2001.
2. Das, B.M., "Principles of Foundation Engineering", 8th edition, Cengage Learning, 2016.

Other references:

1. Approved Document – Acceptable solution by BCA, June 2018
2. Singapore National Annex to Eurocode 1– Actions on structures (SS EN 1991-1-1 2008)

3. Relevant European Standards
4. Guidelines for Design for Safety, WSH Council, 2011
5. BIM Essential Guide – For C&S Consultants, BCA, Aug 2013
6. Code for Environmental Sustainability of Buildings, 3rd Edition, BCA, 2012.
7. Design for Maintainability Checklist, Version 1.3, BCA, Sep 2016

Course Policies and Student Responsibilities

(1) General

You are expected to complete all scheduled project assignments and reports by due dates. You are expected to participate in all group project discussions and activities.

(2) Absenteeism

Group work requires each member to contribute to team work. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

(3) Peer Assessment

You will have a chance to evaluate your peers at the end of the course to ensure that every team member contributes to the success of the team project. Your evaluation will not be known to the other team members and we encourage your honesty in evaluating your peers.

(4) Minutes of meeting

You are expected to record the meeting minutes using a template that will be shared with you in class to ensure individual accountability and responsibility for all your group members. The minutes of the meeting is an important source of reference document that I will use to ensure that all team members contribute to the success of the project. Therefore, it is important that you keep the minutes up to date, circulated among your team members and submit in a timely manner.

Should there is doubt of any act sabotage and cheating, school will investigate, and disciplinary action might be taken.

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, collusions 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 LO	Readings/ Activities
1.	Course and Project Overview Architecture and Building Information Management (BIM)	1, 2, 4, 5, 6	Team formation, understand the project requirements. Literature search of material for execution of design projects.
2.	BIM & Foundation Design and Construction Management	1, 2, 3, 4, 5,6	Team formation, nomination of PM, understand and identify project tasks.
3.	Reinforced Concrete and Steel Design	1, 2, 3, 4, 5,6	Read course ppt slides. Consultation with project instructor. Literature search of material for execution of design projects.
4.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Literature search of material for execution of design projects.
5.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
6.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
7.	Consultation/Progress Report	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
8.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
9.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
10.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
11.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
12.	Consultation	1, 2, 3, 4, 5,6	Consultation with project instructor. Execution of design projects.
13.	Final Report and Short Presentation	1, 2, 3, 4, 5,6	Presentation and Final Report Submission

Appendix 1: Assessment Criteria for Minutes of Meeting (MOM) & Task Lists

	Performance Level/Criteria			
Performance Indicators	**Outstanding: 4**	**Good: 3**	**Average, meet expectation: 2**	**Below expectations: 1**
Content of Minutes of Meeting / Task List	Content is relevant, neat & concise, well balanced and with proper follow up on the status, action parties and dates.	Content is comprehensive and relevant, with appropriate follow up records.	Content is comprehensive and relevant, but not all items are properly followed up.	Content not sufficient or not meaningful.
Task identifications and task owner allocations	Comprehensive tasks identified, tasks owner assigned with proper deadlines.	Majority of tasks identified, listed and task owner mostly assigned with deadlines.	Key tasks identified for all sub-groups.	Missing of major key tasks.
Timing & Signing off	MOMs are properly circulated, signed off and submitted on time.	MOMs are signed off and submitted on time.	MOMs are signed off and submitted, sometimes after reminders.	MOMs are not submitted on time or no proper minutes recording or signing off.
Fair, objective & well-balance recording in the minute of meeting	MOMs are relevant, objective & fair in representative records of actual events.	MOM is generally accurate in reflecting the actual events during project execution, mostly factual.	MOMs are reflecting actual events in general, sometimes contain opinions instead of facts.	MOMs are biased towards some members.

Appendix 2: Assessment Criteria for Presentation

	Performance Level/Criteria			
Performance Indicators	**Outstanding: 4**	**Good: 3**	**Average, meet expectation: 2**	**Below expectations: 1**
Teamwork	Presentation content well integrated and workloads well distributed.	All sub-group contributed to the presentation materials. Contents are reasonably coordinated.	All sub-group contributed to the preparation of presentation material.	Some sub-group did not contribute to the presentation material.
Presentation	Presentation with good flows of arguments. Well-coordinated works among the sub-group. Contains good selling points.	Smooth presentations. Good match of sub-group materials.	Presentation cover critical aspects appropriately. Some mis-match among sub-groups materials.	Boring presentation without clear focus and insufficient details or logical arguments. Many mis-match among sub-group materials.

Appendix 3: Assessment Criteria for Progress Report & Final Report

	Performance Level/Criteria			
Performance Indicators	**Outstanding: 4**	**Good: 3**	**Average, meet expectation: 2**	**Below expectations: 1**
Report layout, format & quality of figures and tables.	Virtually no error, Layout & format consistent, sketches, calculations, figures and tables are relevant, neat & clear.	Layout & format consistent, sketches, calculations, figures and tables are informative and of good quality.	Layout & format consistent, sketches, calculations, figures and tables of acceptable quality.	Layout & format not consistent, sketches, calculations, figures and tables not clear or not relevant.
Apply correct design principles and methodology	Correct principles and methodology applied in design, with clear listing of assumptions.	Correct principles and methodology applied in design	Mostly correct principles and methodology applied in design	Design based on incorrect principles and methodology
Integrate different components of design proficiently	The various design components are fully and compatibly integrated.	Design components can function as a whole.	Design components can function as a whole, with some changes.	Most design components do not function as a whole. Major changes required.
Consider practicality of project during design process	Practical aspect well considered in the design.	Proposed design can be readily and practically implemented.	Proposed design can be implemented without major changes.	Proposed design can be implemented with some changes.
Reference to stakeholders and statutory requirements.	Appropriate reference to the relevant design codes and guidelines.	Design codes and guidelines were referred and somewhat followed.	Design codes and guidelines were referred, but not always followed.	No reference to any design guides.

Appendix 4: Assessment Criteria for Peer Assessment

	Performance Level/Criteria			
Performance Indicators	**Outstanding: 4**	**Good: 3**	**Average, meet expectation: 2**	**Below expectations: 1**
Collaborative behaviour	Cooperative and always delivered assigned tasks on time. Take initiative to help other to ensure success of team project.	Cooperative and always delivered assigned tasks on time. Willing to assist others upon request.	Stop short at delivering assigned tasks, sometimes after reminder(s).	Uncooperative, non-committed, always miss deadlines.
Quality of works	Quality of works higher than overall group quality, or go extra miles to assist teammate to enhance the quality of group works.	Good quality of deliverables under individual responsibility.	Acceptable quality of deliverables under individual responsibility.	Quality of works not acceptable.
Ideas & participations	Active participation and initiatives, good ideas & suggestions in enhancing the quality of group works.	Contributed suggestions and ideas to enhance the quality of group works.	Somewhat contributed in enhancing the quality of group works.	Did not participate in group works.

Average Peer Assessment Score	MF
3.51 to 4.00	1.05
2.76 to 3.50	1.00
2.51 to 2.75	0.95
2.00 – 2.50	0.9
Below 2.0	Separate Assessment

Peer assessment exercise will be anonymous and done towards the end of the semester.

For student who has average peer assessment score below 2.0, Course coordinator might contact/call up the student as well as the Project Manager, and/or contact any other team member(s) to further assess the appropriate MF.

In addition to peer assessment, MF might be moderated by course coordinator and panel judges from the interaction during consultation, minutes of meeting, feedbacks from PM and other team members.