Subject Description Form

Subject Code	CSE577
Subject Title	Advanced Structural Design
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Recommended background knowledge: Students should have a fundamental understanding of structural analysis and design consistent with undergraduate level in civil and structural engineering. Exclusions: CSE528 Advanced Structural Steel Design CSE572 Fire Engineering and Fire Protection
Objectives	To provide students with an understanding of the structural behaviour of concrete, steel and steel-concrete composite structures, and also with a working knowledge in designing building members and systems to codified methods at both cold and hot states.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. to apply the fundamental knowledge of advanced structural design to formulate effective solutions to the engineering problems relevant to high-rise buildings and long span structures, and contribute to professional leadership in a design team; b. to carry out performance-based design on reinforced concrete, steel and steel-concrete composite structures, and to identify, differentiate and analyze diverse practical problems arising from changing economical, geographical, environmental and technological considerations; c. to think holistically and analytically in dealing with complex problems and situations, and able to demonstrate problem-solving skills during practical design; and d. to learn and reflect on engineering design through continual professional development.
Subject Synopsis/ Indicative Syllabus	**Keyword Syllabus** i) Design philosophy in Eurocodes Overview on modern structural design codes; evolution of Eurocodes; basis of design; introduction to EN1990; load combinations; introduction to EN1991; notation and

	conventions; partial factors; prescriptive approach; performance-based design. ii) <u>Steel structures to EN1993-1-1</u> Design strengths; resistances of cross-sections; elastic buckling; resistances under combined actions; resistances of members; flexural and lateral-torsional buckling; material yielding against elastic buckling; unified buckling curves; modified slenderness ratios; choice of design parameters; beam-column framework; advanced applications. iii) <u>Steel-concrete composite structures to EN1994-1-1</u> Composite actions; plastic stress block approach; composite beams with profiled steel decking; composite columns; fully encased sections; concrete in-filled sections; resistances of cross-sections; resistances of members; combined compression and (bi-axial) bending; rigid and deformable shear connectors, push-out tests; full and partial shear connection; slippage demand on shear connectors; load sharing between steel and concrete; advanced applications. iv) <u>Heat transfer</u> Fire behaviour; real fires in real structures; heat transfer; heat release rates and heat contents; basic quantities; analytical methods and numerical simulations; codified design to EN1991-1-2. v) <u>Structural fire engineering</u> General principles; behaviour of common constructional materials at elevated temperatures; standard fire tests; failure criteria; thermal and structural responses; prescriptive approach; performance-based approach; fire resistant design; structural behaviour, analysis and design of concrete, steel and concrete-steel composite structures to Parts 1.2 of EN1992-1, 1993-1 and 1994-1.
Teaching/Learning Methodology	Lectures will provide fundamental knowledge relating to the structural behaviour, analysis and design of building structures at both cold and hot states. Both worked examples on practical design and computational simulation will also be presented. Assignments will be provided to students for them to comprehend and work through the contents systematically. Seminars will allow practising engineers to present case studies on engineering construction projects, and to update the current trends of design practice in the industry to the students.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a.	b.	c.	d.
1. Continuous Assessment	40%	✓	✓	✓	✓
2. Written Examination	60%	✓	✓	✓	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment is based on the coursework assignments, and written examination is evaluated in the examination.

Students must attain at least Grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

Reading List and References

Books

Davison, B. & Owens, G.W.: *The Steel Designers' Manual*, the Steel Construction Institute, 7th Ed., 2012.

Codes of Practice

Code of Practice for Structural Use of Concrete. Buildings Department, the Government of Hong Kong SAR, 2004.

Code of Practice for Structural Use of Steel. Buildings Department, the Government of Hong Kong SAR, 2011.

Various parts of BS5950 Structural Use of Steelwork in Buildings, British Standards Institution.

Various parts of *Eurocode 3 Design of Steel Structures, EN 1993-1-1* and *Eurocode 4 Design of Steel and Composite Structures, EN 1994-1-1*, European Committee for Standardization.

Journals

Engineering Structures, Elsevier Science Limited.
Fire Safety Journal.
Journal of Constructional Steel Research, Elsevier Science Limited.
Journal of Fire and Materials.
Journal of Fire Protection Engineering.
Journal of Structural Engineering, American Society of Civil Engineers.
The Structural Engineer, Institution of Structural Engineers.