Subject Description Form

Subject Code	CSE49491
Subject Title	Passive Fire Protection and Structural Resilience
Credit Value	3
Level	4
Pre-requisite	Nill
Exclusion	CSE40491 Passive Fire Protection Systems Analysis
Objectives	(1) To equip students with general knowledge about the ability of buildings and infrastructure to adapt and recover from a disturbance or damage during a natural or man-made disaster. (2) To enable students to have fundamental knowledge about the countermeasures to ensure structural resilience of buildings and infrastructure. (3) To enable students to understand fundamental principles, design and construction methodology on passive fire protection in building structures. (4) To enable students to exercise engineering judgment on passive fire protection in practical applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand the essence of and acquire basic knowledge about the structural resilience of buildings and infrastructure. b. understand how to achieve structural resilience of buildings and infrastructure through appropriate material use, design, maintenance and intervention. c. apply the fundamentals of applied science, mathematics, and statistical methods to formulate effective solutions across a wide range of structural and fire engineering domains. d. identify, structure and analyse diverse problems arising from the changing constraints that influence engineering projects, such as economic, environmental, legal, social, health and safety, sustainability, and technological considerations. e. recognize the need for and to engage in life-long learning. The above-mentioned are written in line with the outcomes of the degree programme.
Subject Synopsis/ Indicative Syllabus	Keyword Syllabus 1. Fundamentals about structural resilience Multiple hazards, Robustness, Resourcefulness, Redundancy, Restorability, Collapse prevention, Seismic resilience, Fire resilience. 2. Maintenance and intervention of structural performance Life cycle performance maintenance concept, repair and strengthening.

3. Design philosophy for fire resilience
   Limit states, Structural fire resistant design, Prescriptive design against fires, Performance-based design against fires, Common passive fire protection systems and their installation methods.

4. General principles for fire resilience and heat transfer
   Real fire scenarios, Standard fire tests, Failure criteria, Fire resistant periods, Fire resistant construction types, Materials and interior finishes, Heat transfer, Heat release rates and heat contents, Analytical methods and numerical simulations.

5. Fire safety and protection
   Compartmentation, Emergency egress and fireman access route design, Places of temporary and longer term refuge concept, Smoke containment and protection of openings, Effectiveness of passive fire protection systems.

6. Laboratories

a) Mechanical tests on constructional materials at elevated temperatures.
b) Computer simulation on fire safety and performance of a reinforced concrete building.

Teaching/Learning Methodology

Fundamental knowledge will be covered in lectures. Tutorials will provide opportunities for discussion of lecture materials and will also be conducted in the form of example class and problem-solving session to supplement understanding from lectures. Students will also conduct a project to apply the learned knowledge in lectures.

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	e
1. Assignments and laboratory reports	35%	✓	✓	✓	✓	
2. Seminar Report	5%				✓	✓
2. Final Examination	60%	✓	✓	✓		
Total	100 %					

Notes:
Continuous assignments include tutorial assignments and laboratory reports.

Students must pass the final examination and achieve a passing overall score/ grade to pass the subject.

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

The students will be assessed with three components, i.e., the tutorial assignments and laboratory reports, seminar report, and a final examination at the end of the semester. The students will be required

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<tr><td></td><td colspan="2">to attend tutorial sessions and submit assignments. These tutorial sessions will enable students to acquire basic techniques and problem solving. The works in the tutorial sessions are closely related to passive fire protection technology and its application in practice. Students will have to exercise engineering judgments to complete the tutorial assignments. All the tutorial assignments are best to achieve intended learning outcomes a, b, c and d. Students will also be required to attend a technical seminar closely relevant to the subject and submit a seminar report. This will help students to understand the design and technology limitations and enhance their life-long learning ability and achieve the intended learning outcomes d and e. The final examination will consolidate students' learning in lectures, tutorials and laboratories. It is most appropriate to achieve the intended learning outcomes a, b, and c.</td></tr>
<tr><td rowspan="5">Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials / Laboratory sessions</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self Study and Project Works</td><td>6 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1.<u>Books</u>

Morris, WA, Read, REH and Cook GMW. Guidelines for the construction of fire resisting structural elements. Building Research Establishment, 1988.

Structural Fire Safety: A Handbook for Architects and Engineers. The Steel Construction Institute, 1999.

Design guide for fire prevention of buildings 2000: A Code of practice for the Protection of Business. The Loss Prevention Council, 2000.

Resilience of critical infrastructure systems: Emerging developments and future challenges, Edited by Z. Wu, X. Lu & M. Noori, CRC Press, Taylor & Francis Group, 2020.

2.<u>Design Standards</u>

Code of Practice on Fire Resistant Construction. Building Authority, the Government of Hong Kong SAR, 1996.

Code of Practice for the Provision of Means of Escape in Case of Fire. Building Authority, the Government of Hong Kong SAR, 1996.

Code of Practice for the Provision of Means of Access for Firefighting and Rescue Purposes. Building Authority, the Government of Hong Kong SAR, 2004.</td></tr>
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	Code of Practice for Fire Safety in Buildings 2011 (2024 Edition). Building Authority, the Government of Hong Kong SAR, 2024. Code of Practice for Structural Use of Concrete 2013 (2020 Edition). Buildings Department, the Government of Hong Kong SAR, 2020. Code of Practice for Structural Use of Steel 2011(2023 Edition). Buildings Department, the Government of Hong Kong SAR, 2023. BS EN1365 Part1:Fire resistance tests for loadbearing elements – Walls, 2012. Part 2:Fire resistance tests for loadbearing elements – Floors and roofs, 2014. Part 3:Fire resistance tests for loadbearing elements – Beams, 2000. Part 4:Fire resistance tests for loadbearing elements – columns, 1999. EN 1992-1-2: Eurocode 3: Design of concrete structures – Part 1.2: General rules – Structural fire design, 2010. EN 1993-1-2: Eurocode 3: Design of steel structures – Part 1.2: General rules – Structural fire design, 2005. EN 1994-1-2: Eurocode 4: Design of composite steel and concrete structures Part 1.2: General rules – Structural fire design, 2005.