

### Subject Description Form

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| <b>Subject Code</b>                              | CSE40491  |
| <b>Subject Title</b>                             | Passive Fire Protection Systems Analysis  |
| <b>Credit Value</b>                              | 3   |
| <b>Level</b>                                     | 4   |
| <b>Pre-requisite</b>                             | CSE30301 Structural Analysis<br>CSE30310 Design of Concrete Structures<br>CSE30311 Design of Steel Structures   |
| <b>Objectives</b>                                | <p>(1) To enable the students to understand fundamental principles and design methodology on passive fire protection in building structures.</p> <p>(2) To introduce students to various construction methodology of passive fire protection.</p> <p>(3) To enable students to exercise engineering judgment on passive fire protection in practical applications.</p>  |
| <b>Intended Learning Outcomes</b>                | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. apply the fundamentals of applied science, mathematics, and statistical methods to formulate effective solutions across a wide range of structural and fire engineering domains;</li> <li>b. 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;</li> <li>c. communicate logically and lucidly through drawing, calculation, and in writing; and</li> <li>d. to recognize the need for, and to engage in life-long learning.</li> </ol> <p>The above-mentioned are written in line with the outcomes of the degree programme.</p> |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <p>Keyword Syllabus</p> <ol style="list-style-type: none"> <li>1. General principles of design and applications<br/>Real fires in real structures. Fire resistant construction types, materials and interior finish. Fire resistant periods. Heat transfer. Heat release rates and heat contents. Analytical methods and numerical simulations.</li> <li>2. Standard fire tests.<br/>Codified temperature-time curves. Testing procedures. Failure criteria and assessment to structural adequacy.</li> <li>3. Design philosophy and general principles.<br/>Limit states. Structural fire resistances. Prescriptive design against fires. Performance-based design against fires. Common passive</li> </ol>  |

|   | <p>fire protection systems and their installation methods.</p> <p>4. Fire safety and protection<br/>Compartmentation. Emergency egress and fireman access route design, places of temporary and longer term refuge concept, smoke containment and protection of openings.</p> <p>5. Case studies to fire damaged buildings and tunnel structures.<br/>Buildings and tunnel structures with different degrees of damages. Causes of fires. Effectiveness of passive fire protection systems. Extensive spalling of concrete. Combustible constructional elements, and facades.</p> <p>6. Laboratories</p> <p>a) Mechanical tests on constructional materials at elevated temperatures</p> <p>b) Computer simulation on fire safety and performance of a reinforced concrete building.</p> <p>c) Computer simulation on structural fire performance of a long span steel truss under fire with passive fire protection.</p>  |                                   |             |  |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
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| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>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.</p>   |                                   |             |  |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="512 1115 1385 1509"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Assignments and laboratory reports</td> <td>28 %</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>2. Seminar Report</td> <td>2%</td> <td></td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>2. Final Examination</td> <td>70%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><i>Notes:</i><br/>Continuous assignments include tutorial assignments and laboratory reports.</p> <p><b>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.</b></p> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>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</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |  | a | b | c | d | 1. Assignments and laboratory reports | 28 % | ✓ | ✓ | ✓ |  | 2. Seminar Report | 2% |  |  |  | ✓ | 2. Final Examination | 70% | ✓ | ✓ | ✓ |  | Total | 100 % |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
|   |  | a                                 | b           | c  | d |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
| 1. Assignments and laboratory reports   | 28 %   | ✓                                 | ✓           | ✓  |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
| 2. Seminar Report   | 2%   |                                   |             |  | ✓ |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
| 2. Final Examination  | 70%  | ✓                                 | ✓           | ✓  |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |
| Total   | 100 %  |                                   |             |  |   |  |  |   |   |   |   |                                       |      |   |   |   |  |                   |    |  |  |  |   |                      |     |   |   |   |  |       |       |  |  |  |  |

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|   | <p>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, and c. 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 enhance their life-long learning ability and achieve the intended learning outcomes d. 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.</p>   |                               |
| <p><b>Student Study Effort Expected</b></p> | <p>Class contact:</p>   | <p>Average hours per week</p> |
|   | <ul style="list-style-type: none"> <li>▪ Lectures / Tutorials / Laboratory sessions</li> </ul>  | <p>3 Hrs.</p>                 |
|   | <p>Other student study effort:</p>  |                               |
|   | <ul style="list-style-type: none"> <li>▪ Self Study and Project Works</li> </ul>  | <p>6 Hrs.</p>                 |
|   | <p>Total student study effort</p>   | <p>9 Hrs.</p>                 |
| <p><b>Reading List and References</b></p>   | <p>1. <u>Books</u></p> <p>Morris, WA, Read, REH and Cook GMW. Guidelines for the construction of fire resisting structural elements. Building Research Establishment, 1988.</p> <p>Structural Fire Safety: A Handbook for Architects and Engineers. The Steel Construction Institute, 1999.</p> <p>Design guide for fire prevention of buildings 2000: A Code of practice for the Protection of Business. The Loss Prevention Council, 2000.</p> <p>2. <u>Design Standards</u></p> <p>Code of Practice on Fire Resistant Construction. Building Authority, the Government of Hong Kong SAR, 1996.</p> <p>Code of Practice for the Provision of Means of Escape in Case of Fire. Building Authority, the Government of Hong Kong SAR, 1996.</p> <p>Code of Practice for the Provision of Means of Access for Firefighting and Rescue Purposes. Building Authority, the Government of Hong Kong SAR, 2004.</p> <p>Code of Practice for Fire Safety in Buildings. Building Authority, the Government of Hong Kong SAR, 2015.</p> |                               |

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| <p>Code of Practice for Structural Use of Concrete. Buildings Department, the Government of Hong Kong SAR, 2013.</p> <p>Code of Practice for Structural Use of Steel. Buildings Department, the Government of Hong Kong SAR, 2011.</p> <p>BS EN1365<br/>Part 1: Fire resistance tests for loadbearing elements – Walls, 2012.</p> <p>Part 2: Fire resistance tests for loadbearing elements – Floors and roofs, 2014.</p> <p>Part 3: Fire resistance tests for loadbearing elements – Beams, 2000.</p> <p>Part 4: Fire resistance tests for loadbearing elements – columns, 1999.</p> <p>EN 1992-1-2: Eurocode 3: Design of concrete structures – Part 1.2: General rules – Structural fire design, 2010.</p> <p>EN 1993-1-2: Eurocode 3: Design of steel structures – Part 1.2: General rules – Structural fire design, 2005.</p> <p>EN 1994-1-2: Eurocode 4: Design of composite steel and concrete structures<br/>Part 1.2: General rules – Structural fire design, 2005.</p> |
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