# Subject Description Form

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| **Subject Code** | CSE531 |
| **Subject Title** | Wind Engineering |
| **Credit Value** | 3 |
| **Level** | 5 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Recommended background knowledge:<br><br>Students should have a fundamental understanding of engineering mathematics, structural analysis, and structural dynamics consistent with undergraduate level study in civil or structural engineering. |
| **Objectives** | To provide the students with fundamental knowledge of wind environment, wind loading, wind-induced responses, vibration mitigation, and wind tunnel tests of buildings and structures. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able:<br><br>a. to apply the fundamental knowledge and *Code of Practice on Wind Effects in Hong Kong* to determine wind loads on a structure;<br><br>b. to apply the fundamental knowledge and *Code of Practice on Wind Effects in Hong Kong* to calculate dynamic responses of different buildings under wind loads;<br><br>c. to understand the principles of commonly used vibration mitigation technologies and wind tunnel test techniques;<br><br>d. to work with others to find solutions for relevant problems; and<br><br>e. to have creative and critical thinking, and to undertake individual projects. |
| **Subject Synopsis/ Indicative Syllabus** | **Keyword Syllabus**<br><br>i) Wind Environment<br><br>The nature of wind; the wind structure near the ground, the probability and statistics of wind speed; extreme wind climatology.<br><br>ii) Wind Loading<br><br>Wind pressure; flow separation mechanisms; wake flows; pressure coefficient; force coefficient; wind loading on structures.<br><br>iii) Random Vibration<br><br>Statistical description of random functions; probability distribution and correlation; Fourier transform; spectral analysis; structural response to random excitation.<br><br>iv) Wind-Induced Vibrations<br><br>Along-wind response of structures; cross-wind response of structures; wind-induced torsional vibration of tall buildings; acceleration comfort criteria for tall buildings. |

v) <u>Wind-Induced Vibration Mitigation</u>

Tuned mass dampers; liquid dampers; viscoelastic dampers; practical design consideration for tall buildings; case studies.

vi) <u>Wind Tunnel Studies</u>

Boundary layer wind tunnels; model scaling requirements; modelling of wind; types of wind tunnel model tests; wind tunnel instrumentation; wind tunnel test expectations.

**Teaching/Learning Methodology**

Face to face lectures will be delivered to provide students with fundamental knowledge of wind environments, random vibration, wind actions, structural responses, and wind-induced vibration mitigation. *Code of Practice on Wind Effects in Hong Kong* is also presented to provide practical reference.

Students will be required to undertake four assignments, which enable them to digest the contents thoroughly.

Tutorials will be provided so that the students have more opportunities to study the real examples and strengthen their understanding on the subject contents. They will also provide opportunities for students and lecturer to communicate and discuss any difficulty during learning.

A field visit on a wind tunnel laboratory will be arranged to provide the students with opportunities to understand wind tunnel test technologies and their real applications. Students will be required to write a technical report on wind tunnel studies after the visit.

**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. 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 will be based on four assignments and one technical report on wind tunnel studies.

Written examination is evaluated by final 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.

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| **Reading List and References** | **<u>Books</u>**<br><br>*ASCE Manuals and Reports on Engineering Practice No. 67 Wind tunnel studies of buildings and structures*, American Society of Civil Engineers, NY, (1999).<br><br>AS/NZ1170.2, Australian/New Zealand Standard, Structural Design Actions, Part 2: Wind Action, Standards Australia & Standards New Zealand 2002.<br><br>Hong Kong Building Development Department, *Code of Practice on Wind Effects*, Hong Kong 2004 (2004).<br><br>Liu, H. *Wind Engineering – A Handbook For Structural Engineers*, Prentice Hall, (1991).<br><br>Newland, D.E. *An Introduction To Random Vibrations, Spectral And Wavelet Analysis*, 3rd Ed., Longman, (1993).<br><br>Paz, M. *Structural Dynamics-theory And Computation*, 4th Ed., Van Nostrand Reinhold, NY, (1997).<br><br>Simiu E. and Scanlan R.H. *Wind Effects On Structures*, 3rd Ed., John Wiley & Sons, Inc., (1996).<br><br>**<u>Journal and Conference Proceedings</u>**<br><br>Journal of Wind Engineering and Industrial Aerodynamics<br><br>Journal of Wind & Structures<br><br>Proceedings of the International Conferences on Wind Engineering |