City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2016/ 17

Part I Course Overview

Course Title:	Boundary-Layer Meteorology and Wind Energy Engineering
Course Code:	SEE6202
Course Duration:	One semester
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course is designed for students in the M.Sc. Energy and Environment programme. It will provide students with knowledge of the physical factors governing small-scale winds, the influence of these winds on the urban environment, and implications for wind energy engineering. Basic material from fluid dynamics and meteorology will be reviewed. Applications to atmospheric modelling, pollutant dispersion, urban planning, indoor ventilation, wind turbine design and wind farms will be described. Closely related topics (e.g. urban climate and the urban heat island) will also be discussed.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Apply the equations of fluid dynamics	20		✓	
2.	Describe the structure of the atmospheric boundary layer	30		✓	
3.	Describe the effect of the urban environment on winds and pollutant dispersion	30	✓	✓	
4.	Describe implications of boundary-layer meteorology and urban aerodynamics for wind energy engineering	20	✓	✓	
		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lectures	Explain key concepts	✓	✓	✓	✓			2.5
Tutorials	Additional review and problems	✓	✓	✓	✓			0.5

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 50 %								
Midterm	✓	✓					20	
Homework	✓	✓	✓	✓			15	
Project	✓	✓	✓	✓			15	
Examination: 50% (duration: 2 hours, if applicable)								
							100%	

Percentage of coursework, examination, etc.: 50% by coursework; 50% by exam

To pass a course, a student must do ALL of the following:

1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);

2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and

3) meet the criteria listed in the section on Grading of Student Achievement.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Adequate (C+, C, C-)	Marginal (D)	Failure (F)
1. In-class test	Ability to analyse and solve practical problems related to boundary-layer meteorology and wind engineering	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments / Project	Ability to evaluate and analyse questions related to boundary-layer meteorology and wind energy engineering	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Final exam	Ability to analyse and solve practical problems related to boundary-layer meteorology and wind engineering	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

Mesoscale meteorology; microscale and urban meteorology; aerodynamics; turbulence; closure; wind tunnel; computational fluid dynamics; subgrid-scale parameterisation; boundary conditions; boundary layer; convective, nocturnal and internal boundary layers; sonic anemometer; log profile; roughness length; Monin-Obukhov similarity theory; urban canopy; Gaussian plume; urban heat island; street canyon; indoor ventilation; wind engineering; wind turbines; wind farms; wind resource assessment; noise generation.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	
2.	
3.	
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	T.R. Oke, *Boundary-layer Climates*, Routledge, London, 1990.
2.	T. Foken, *Micrometeorology*, Springer, 2008.
3.	J. C. Wyngaard, *Turbulence in the Atmosphere*, Cambridge University Press, Cambridge, 2008.
4.	P. Jain, *Wind Energy Engineering*, McGraw-Hill, 2011.
5.	J. F. Manwell, J. G. McGowan, A. L. Rogers, *Wind Energy Explained: Theory, Design and Application*, Second Edition, Wiley, 2009.
6.	C.C. Baniotopoulos, C. Borri, and T. Stathopoulos (eds*), Environmental Wind Engineering and Design of Structures*, Springer, 2011.