City University of Hong Kong
Course Syllabus

offered by
Department of Architecture and Civil Engineering
with effect from Semester A 2022 / 2023

Course Title:	Structural Dynamics and Applications
Course Code:	CA8010
Course Duration:	1 Semester (Some courses offered in Summer Term may start a few weeks earlier than the normal University schedule. Please check the teaching schedules with CLs before registering for the courses.)
Credit Units:	3
Level:	R8
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)*	BC8010 Structural Dynamics and Applications
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims at equipping students with knowledge in structural dynamics, stability and vibration control with a balanced scope on fundamentals, research and applications. Basic topics include single-degree-of-freedom (SDOF) systems, multi-degree-of-freedom (MDOF) systems and continuous systems. It also includes advanced topics such as structural stability, random vibrations, damping in structures, vibration control, theory and dynamics of plates, wind and earthquake engineering.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	establish governing equations for linear-elastic structural dynamics problems with common structural elements;			✓	
2.	apply effectively analytical and numerical techniques for analyzing dynamic response of SDOF and MDOF linear-elastic structures under different characteristic types of loading;			✓	
3.	identify vibration problems and apply structural dynmaics concepts to its mitigation;			✓	
4.	apply probability theory to analysis of linear-elastic vibration of structures subjected to stochastic loads;			✓	
5.	perform vibration testing of structures using common techniques;			✓	
6.	apply structural dynamics to basic assessment of structural response due to wind and earthquake loads.			✓	
7.	discover the basic attributes affecting the dynamic response of structures				✓
* If weighting is assigned to CILOs, they should add up to 100%.		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)

TLA	Brief Description	CILO No.							Hours / week (if applicable)
		1	2	3	4	5	6	7	
Lectures	Structural dynamics; SDOF and MDOF systems; Wind and earthquake engineering; Stability of structures; Vibration control	✓	✓	✓	✓	✓	✓	✓	2
Tutorials	Examples and applications in structural dynamics and earthquake engineering	✓	✓	✓	✓	✓		✓	1

Semester Hours:	3 hours per week
Lecture/Tutorial/Laboratory Mix:	Lecture (2); Tutorial (1); Laboratory (0)

4. Assessment Tasks/Activities

Assessment Tasks / Activities	CILO No.							Weighting*	Remarks
	1	2	3	4	5	6	7		
Continuous Assessment: 50%									
Assignments	✓	✓	✓	✓			✓	50%	
Examination: 50% (duration: 3 hour(s))									
Examination								50%	
* The weightings should add up to 100%.								100%	

To pass a course, a student must obtain minimum marks of 30% in both coursework and examination components, and an overall mark of at least 40%

5. Assessment Rubrics

<u>Applicable to students admitted in Semester A 2022/23 and thereafter</u>

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
Assignments	1. (CILO 1) Ability to establish the governing equations of motions for linear-elastic structures; 2. (CILO 2) Ability to analyze dynamic response of SDOF and MDOF linear-elastic structures under wind or earthquake load; 3. (CILO 3) Ability to apply structural dynamics concepts to mitigate undesired structural vibrations; 4. (CILO 4) Ability to apply probability theory to analyze linear-elastic vibration of structures subjected to stochastic loads; 5. (CILO 7) Ability to identify the key factors affecting the dynamic responses of realistic structures.	Both the solution procedures and results are correct.	The solution procedures demonstrate a moderate level of understanding about the correct strategy with few minor errors and/or theory in resolving the given problems.	The solution procedures demonstrate significant /major conceptual errors about the strategy and/or theory in resolving the given problems.	Not even reaching the marginal level.
Examination	1. (CILO 1) Ability to establish the governing equations of motions for linear-elastic structures; 2. (CILO 2) Ability to analyze dynamic response of SDOF and MDOF linear-elastic structures under wind or earthquake load; 3. (CILO 3) Ability to apply structural dynamics concepts to mitigate undesired structural vibrations; 4. (CILO 4) Ability to apply probability theory to analyze linear-elastic vibration of structures subjected to stochastic loads; 5. (CILO 7) Ability to identify the key factors affecting the dynamic responses of realistic structures.	Both the solution procedures and results are correct.	The solution procedures demonstrate a moderate level of understanding about the correct strategy with few minor errors and/or theory in resolving the given problems.	The solution procedures demonstrate significant /major conceptual errors about the strategy and/or theory in resolving the given problems.	Not even reaching the marginal level.

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
Assignments	1. (CILO 1) Ability to establish the governing equations of motions for linear-elastic structures; 2. (CILO 2) Ability to analyze dynamic response of SDOF and MDOF linear-elastic structures under wind or earthquake load; 3. (CILO 3) Ability to apply structural dynamics concepts to mitigate undesired structural vibrations; 4. (CILO 4) Ability to apply probability theory to analyze linear-elastic vibration of structures subjected to stochastic loads; 5. (CILO 7) Ability to identify the key factors affecting the dynamic responses of realistic structures.	Both the solution procedures and results are correct.	The solution procedures demonstrate a moderate level of understanding about the correct strategy and/or theory in resolving the given problems.	The solution procedures demonstrate a few minor conceptual errors about the strategy and/or theory in resolving the given problems.	The solution procedures demonstrate major conceptual errors about the strategy and/or theory in resolving the given problems.	Not even reaching the marginal level.
Examination	1. (CILO 1) Ability to establish the governing equations of motions for linear-elastic structures; 2. (CILO 2) Ability to analyze dynamic response of SDOF and MDOF linear-elastic structures under wind or earthquake load; 3. (CILO 3) Ability to apply structural dynamics concepts to mitigate undesired structural vibrations; 4. (CILO 4) Ability to apply probability theory to analyze linear-elastic vibration of structures subjected to stochastic loads; 5. (CILO 7) Ability to identify the key factors affecting the dynamic responses of realistic structures.	Both the solution procedures and results are correct.	The solution procedures demonstrate a moderate level of understanding about the correct strategy and/or theory in resolving the given problems.	The solution procedures demonstrate a few minor conceptual errors about the strategy and/or theory in resolving the given problems.	The solution procedures demonstrate major conceptual errors about the strategy and/or theory in resolving the given problems.	Not even reaching the marginal level.

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

1. Keyword Syllabus

Single-degree-of-freedom (SDOF) systems: free vibration, harmonic loading, periodic loading, general loading. Multi-degree-of-freedom systems (MDOF): natural frequencies and modeshapes, modal analysis, time-stepping schemes. Distributed-parameter systems: governing PDE, eigenvalue problem. Stationary stochastic processes, random vibration of structures; wind engineering; earthquake engineering; structural vibration testing.

2. Reading List

2.1 Compulsory Readings

1.	Nil

2.2 Additional Readings

1.	Clough, R. W. & Penzien, J. (1993), Dynamics of Structures, McGraw-Hill.
2.	Simiu, E. & Scanlan, R. (1986). Wind Effects on Structures, Wiley-Interscience.