Subject Description Form

Subject Code	CSE40418
Subject Title	Advanced Structural Analysis
Credit Value	3
Level	4
Pre-requisites / Exclusion	Pre-requisites : CSE301 Structural Analysis I or CSE30301 Structural Analysis Exclusion: CSE418 Structural Analysis II
Objectives	(1) To give students a workable understanding and appreciation of the principles and analysis methods in relation to structural dynamics, structural stability, and plastic theory; (2) To give students an opportunity to enhance their capacities in thinking critically and logically and solving problems independently.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. apply the fundamentals of applied science, mathematics, and statistical methods to formulate effective solutions to solve problems in structural engineering; b. be familiar with the important issues and philosophies associated with structural dynamics, structural stability and plastic theory; c. be conversant in the terminology of the above areas of advanced structural analysis, and develop a workable understanding of these issues related to structural engineering systems; d. design and conduct experimental studies to validate important theoretical concepts in the above areas; e. explain logically and lucidly structural engineering problems through idealisation, analysis and calculation; f. work with others in a structural design team, identify the nature of various structural problems and take responsibility for a shared activity; g. embrace more advanced structural analysis techniques and further their studies or seek assistance or guidance to engage in life-long learning as a civil engineer.
Subject Synopsis/ Indicative Syllabus	1. Structural Dynamics (7 weeks) Equation of motion. Natural frequency and period. Damping. Dynamic loading. Resonance. Dynamics of single-degree-of-freedom structures. Dynamics of multi-degree-of-freedom structures. Approximate methods. 2. Plastic Theory (3 weeks) Elastic and plastic properties. Ductility. Plastic hinge. Plastic moment. Theorems of plastic analysis. Equilibrium method. Work method. Plastic collapse of fixed-ended and continuous beams. Plastic collapse of portal frames. Yield line theory. 3. Structural Stability (3 weeks) Methods of stability analysis. Types of buckling. Stiffness equations of beam-columns. Stability functions. Linear and geometric stiffness matrices. Instability of frames. Ultimate load analysis of structures. Elastic critical load. Second-order effect. 4. Laboratory Work Harmonically excited vibration of a shear building model. Plastic collapse of a steel beam.

Teaching/Learning Methodology

1. Engaged learning is conducted during lectures;
2. Problem-based learning is conducted during tutorials;
3. Discovery-based learning is conducted during assignment;
4. Cooperative learning is conducted during self-reading;
5. Collaborative learning is conducted during laboratories.

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	f	g
1. Assignment	10	√	√	√				
2. Mid-term test	12	√	√	√				
3. Laboratory	8				√	√	√	√
4. Final examination	70	√	√	√		√		
Total	100 %							

Students must attain at least grade D in coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

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

1. Assignment is to assess the student's capability of applying the knowledge and methods learned to formulate effective solutions to solve problems in structural engineering;
2. Mid-term test is to assess the student's capability of developing a workable understanding of the philosophies behind structural dynamics theory;
3. Laboratories and Reporting in Group is to assess the student's capability of communication, presentation, experimental design and verification, working and negotiation with peers in group, and seeking assistance and guidance to engage in life-long learning as a civil engineer;
4. Final examination is to assess the student's capability of critically analyzing and interpreting a wide range of problems in relation to structural dynamics, structural stability, and plastic theory.

Student Study Effort Expected

Class contact:	Average hours per week
▪ Lectures / Tutorials / Laboratory	3 Hrs.
Other student study effort:	
▪ Assignments / Laboratory Reports / Self-Reading	6 Hrs.
Total student study effort	9 Hrs.

Reading List and References

1. Paz, M. and Kim Y.H. (2018), Structural Dynamics: Theory and Computation, 6th Edition, Springer.
2. Paultre, P. (2010), Dynamics of Structures, John Wiley & Sons.
3. Chen, W.-F. and Lui, E.M. (1987), Structural Stability: Theory and Implementation, PTR Prentice Hall.
4. Simitses, G.J. and Hodges, D.H. (2006), Fundamentals of Structural

	Stability, Butterworth-Heinemann. 5. Ziegler H. (2013), Principles of Structural Stability, 2nd Edition, Springer-Basel AG. 6. Chen, W.-F. and Sohal, I.(2013), Plastic Design and Second-Order Analysis of Steel Frames, Springer-Verlag. 7. Yu, M.H., Ma, G.W. and Li, J.C. (2009), Structural Plasticity: Limit, Shakedown and Dynamic Plastic Analyses of Structures, Springer-Verlag Berlin Heidelberg .