

Subject Description Form

Subject Code	CSE40418
Subject Title	Advanced Structural Analysis
Credit Value	3
Level	4
Pre-requisite/ 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. <u>Structural Dynamics</u> (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. <u>Plastic Theory</u> (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. <u>Structural Stability</u> (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. <u>Laboratory Work</u> 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	<table><tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="7">Intended subject learning outcomes to be assessed</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th></tr><tr><td>1. Assignment</td><td>10%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr><tr><td>2. Mid-term test</td><td>12%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr><tr><td>3. Laboratory</td><td>8%</td><td></td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>4. Final examination</td><td>70%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>Total</td><td>100%</td><td colspan="7"></td></tr></table> Students must pass the final examination and achieve a passing overall score / grade to pass the subject. Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: 1. <u>Assignment</u> 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. <u>Mid-term test</u> is to assess the student’s capability of developing a workable understanding of the philosophies behind structural dynamics theory;	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed							a	b	c	d	e	f	g	1. Assignment	10%	✓	✓	✓					2. Mid-term test	12%	✓	✓	✓					3. Laboratory	8%				✓	✓	✓	✓	4. Final examination	70%	✓	✓	✓		✓			Total	100%							
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed																																																										
		a	b	c	d	e	f	g																																																						
1. Assignment	10%	✓	✓	✓																																																										
2. Mid-term test	12%	✓	✓	✓																																																										
3. Laboratory	8%				✓	✓	✓	✓																																																						
4. Final examination	70%	✓	✓	✓		✓																																																								
Total	100%																																																													

	3. <u>Laboratories and Reporting in Group</u> 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. <u>Final examination</u> 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. Simites, 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.	