Subject Description Form

Subject Code	CSE20204
Subject Title	Advanced Structural Mechanics
Credit Value	3
Level	2
Pre-requisites/ Exclusion	Pre-requisites: CSE20201 Structural Mechanics
Objectives	(1) To offer students a sound understanding of fundamental concepts, theories and principles of structural mechanics, and basic knowledge required for structural analysis and design; (2) To enable students to apply the theory of structural mechanics to analyze the behavior of structures under loads in a simple and logical manner; (3) To train students with basic laboratory techniques of structural testing, and to enable students to logically analyze and interpret the testing results.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the fundamentals of mathematics and mechanics to analyze and find effective solutions to simple structural problems under various load conditions; b. Creatively synthesize knowledge of loads, material strength, and structural analysis to design simple structures and evaluate their performance; c. Present simple structural engineering problems and their solutions logically and lucidly through derivation, calculation, and experimental reports; d. Work with others in a group effectively and cooperatively in experimental and tutorial sessions of the subject; e. Collectively conduct experimental work on the properties of construction materials and the strength, deflection, and stability of simple structures; and f. Identify the limitations and inadequacies of the current subject, and recognize the need for continual learning of advanced subjects in structural engineering and the need for life-long learning.
Subject Synopsis/ Indicative Syllabus	1. Stresses in Beams – Part 2 (4 weeks) Product of inertia. Principal moment of inertia. Beams of composite materials. Unsymmetrical bending. Shear flow. Shear centre. 2. Torsion (1 weeks) Polar moment of inertia. Simple torsion theory. Torsion of circular shafts. Torsion of hollow shafts. Torsion of thin wall tubes. 3. Analysis of Plane Stress and Plane Strain (3 weeks) Stresses on oblique planes. Principal stress. Maximum shear stress. Analysis of strain. The strain rosette. Strain energy. 4. Strength and Design (2 weeks) Combined loading. Maximum normal stress theory. Maximum shear stress theory, Maximum distortion strain energy. Concept of strength and serviceability. Introduction to allowable stress and limit state design. 5. Theory of Columns (3 weeks) Eccentric loading of short columns. Long columns. Euler's column formula. The secant formula. Imperfections. Design formula of long

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6. <u>Laboratory Work</u>
Unsymmetrical bending. Shear centre. Torsion test. Column buckling.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Fundamental knowledge will be covered in lectures. Tutorials will provide opportunities for discussion of lecture materials and will also be conducted in the form of example class and problem-solving session to supplement understanding from lectures. Laboratory work will help students appreciate the basic principles and train them with basic laboratory techniques.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Assignments and lab reports</td><td>18</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Seminar report</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>2. Mid-term test</td><td>10</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>3. Final examination</td><td>70</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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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.

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

The students will be assessed by three components, i.e. the assignments and lab reports, the mid-term test and the final examination. Assignments are intended to provide a timely assessment of lecture contents. The assignments include homework and tutorial question sheets. All the assignments need to be answered and submitted on time. The students will be required to attend laboratory sessions and submit group laboratory reports. These laboratory sessions will enable students to acquire basic laboratory techniques of structural testing. The work in the laboratory sessions provides a supplement to the lectures. Mid-term test mainly provides the assessment of the course materials covered in the first half of the semester. In particular, the assignments will be designed to achieve the learning outcomes a, b, c and f, and the laboratory reports will be designed to achieve the learning outcomes d, and e. Students will also be required to attend a technical seminar closely relevant to the subject and submit a seminar report. This will help students to enhance their life-long learning ability and achieve the intended learning outcomes f. The final examinations will provide a comprehensive assessment to students' learning in lectures, tutorials and laboratories, and it will examine the learning outcomes a, b and c.
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<tr><td rowspan="3">Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials / Laboratory</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
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	▪ Reading and Study	3 Hrs.
	▪ Completion of assignments and laboratory reports	3 Hrs.
	Total student study effort	9 Hrs.
Textbook	Hibbeler, R.C. (2016) "Mechanics of Materials", 10th SI Edition, Pearson. Hibbeler, R.C. (2017) "Structural Analysis", 10th Edition, Pearson.	
Reading List and References	Leet, K.M., Uang, C.M. and Lanning J. (2017) "Fundamentals of Structural Analysis", 5th Edition. McGraw-Hill Eduction. Beer, F.P., Johnston, E.R., Dewolf, J.T., and Mazurek, D.F. (2014) "Mechanics of Materials", 7th Eedition, McGraw-Hill Education. Hulse, R. and Cain, J. (2000) "Structural Mechanics", 2nd Edition, Palgrave. Goodno, B.J. and Gere, J.M. (2017) "Mechanics of Materials", 9th Edition, Cengage Learning. Smith, P. (2001) "Introduction to Structural Mechanics", Palgrave Macmillan. Kassimali A (2014) "Structural Analysis". 5th Edition. Cengage Learning. Popov, E.P. (1998) "Engineering Mechanics of Solids", 2nd edition, Prentice Hall.	