

## Subject Description Form

Subject Code	<b>BSE3301</b>
Subject Title	<b>Numerical Methods and Computing</b>
Credit Value	3
Level	3
Pre-requisite Co-requisite Exclusion	Nil Nil Nil
Objectives	<p>The objectives of this subjects are to</p> <p>(1) Provide students with an understanding of simple analytic and numerical methods of various topics such as linear systems, ordinary and partial differential equations, numerical methods;</p> <p>(2) Enable students to apply the basic techniques to model and solve the mathematical problems in building services engineering using numerical method;</p> <p>(3) Introduce MATLAB to students and enable them to apply MATLAB to create computational code for solving problems in building services engineering;</p> <p>(4) Provide students with background computing knowledge to support their study in later stage, e.g., project works and elective subjects in the final year.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>a) apply mathematical reasoning to analyze essential features of different problems in building services engineering;</p> <p>b) extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations in building services engineering;</p> <p>c) analyze and model application problems using numerical method and fundamental knowledge in building services engineering;</p> <p>d) write computational code using MATLAB for solving problems in application and explain the computation results based on fundamental knowledge in building services engineering.</p>
Subject Synopsis/ Indicative Syllabus	<p><i>Ordinary differential equations</i></p> <p>Basic concept of ordinary differential equations; Numerical methods for solving ordinary differential equations; First and second order solutions; Applications.</p> <p><i>Partial differential equations</i></p> <p>Basic concept of partial differential equations; Heat conduction equations; Fluid dynamic equations; Wave equations; Boundary- and initial- value problems, Separation variables method; Finite difference method; Applications.</p> <p><i>Numerical methods</i></p> <p>Numerical methods for linear systems; LU decomposition; Gauss-Seidel method; Solutions of non-linear equations; Newton-Raphson methods; Numerical integration using trapezoidal and Simpson's rules; Solutions to ordinary differential equations; Euler's and Runge-Kutta methods; Finite difference method for solution of Laplace equation; curve fitting by least squares methods; Applications.</p> <p><i>MATLAB programming</i></p> <p>Introduction to MATLAB; Realization of numerical method using MATLAB; Visualization of computation results in MATLAB; Computational code creation using MATLAB; Applications.</p>
Teaching/Learning Methodology	<p>Lectures: to introduce fundamental concepts and discuss in detail the contents and their applications in everyday engineering problems.</p> <p>Tutorials: to elaborate ideas and answer any queries, to enhance related material, to share and</p>

	<p>exchange ideas, and to improve students' problem solving skills.</p> <p>Labs &amp; Project: to apply mathematical and numerical techniques to solve different problems in building services engineering and enhance computation skills.</p> <p>Assignments: to provide opportunities to test students' understanding (formative &amp; judgmental).</p>																																						
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>Continuous Assessment</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Examination</td> <td>60</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> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>To ensure that students learn and reflect continuously, Continuous Assessment is an important element and students are required to obtain Grade D or above in <u>both</u> the Continuous Assessment and the Examination components. The continuous assessment comprises of assignments, labs, project and in class assessment. The assignments are used to assist the students to reflect and review on their progress. Labs &amp; project will give the student experience in writing and running applications in the MATLAB integrated development environment using the built-in programming language. The in class assessment can let the facilitator to have a better understanding of individual student/students' weaknesses or strength so that remedial actions can be taken timely. It also serves as a judgmental exercise. The end-of-semester examination is used to assess the knowledge acquired by the students and their ability to apply and extend such knowledge.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a	b	c	d			Continuous Assessment	40	✓	✓	✓	✓			Examination	60	✓	✓	✓	✓			Total	100 %						
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Reading List and References	<p>Kreyszig, E. (2011). <i>Advanced Engineering Mathematics</i>, 10<sup>th</sup> edition. Hoboken, N.J.: John Wiley.</p> <p>Gerald, C.F. &amp; Wheatley P.O. (2004). <i>Applied Numerical Analysis</i>, 7<sup>th</sup> edition. Reading, Mass.: Addison-Wesley.</p> <p>Chapra, S.C. &amp; Canale R.P. (2010). <i>Numerical methods for Engineers: with Programming and Software Applications</i>, 6<sup>th</sup> edition. McGraw-Hill Higher Education.</p> <p>Palm, W.J. (2011). <i>Introduction to MATLAB for engineers</i>, 3<sup>rd</sup> edition. McGraw Hill.</p>																																						