Subject Description Form

Subject Code	AMA621
Subject Title	Sobolev spaces and partial differential equations
Credit Value	3
Level	6
Expected background knowledge	Real analysis, Functional analysis, Basic knowledge of Ordinary and Partial Differential Equations would be helpful. Some concepts will be reviewed in the lecture when necessary.
Objectives	To enable students to be familiar with important aspects of modern partial differential equations. The knowledge will be useful to those who will work with PDE on the theoretical or numerical side.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students should be able to: a. Understand Sobolev spaces and use the related theories to study PDEs. b. Understand weak derivatives and analyse the regularity of weak solutions to elliptic and parabolic equations. c. Use Lax-Milgram theorem/Galerkin method and prove the existence and uniqueness of weak solutions.
Subject Synopsis/ Indicative Syllabus	*Sobolev spaces:* Weak derivatives, Sobolev spaces, Sobolev inequalities, Trace, Rellich-Kondrachov compactness. *Elliptic equations* Weak solutions of elliptic boundary value problems, Lax-Milgram theorem, regularity, spectral theory. *Parabolic equations* Weak solutions, Galerkin methods, Regularity.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. Tutorials will be spent answering questions, reviewing some background material, and going over tutorial questions that are related to assignment.

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td colspan="2">
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>1. Assignments</td><td>20%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Mid-term test</td><td>30%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Final exam</td><td>50%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="3"></td></tr>
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</td></tr>
<tr><td>Student Study Effort Required</td><td>Class contact:</td><td></td></tr>
<tr><td></td><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td></td><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td></td><td>Other student study effort:</td><td></td></tr>
<tr><td></td><td>▪ Assignment</td><td>31 Hrs.</td></tr>
<tr><td></td><td>▪ Self-study</td><td>60 Hrs.</td></tr>
<tr><td></td><td>▪ Total student study effort</td><td>130 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">L.C. Evans, Partial Differential Equations, vol. 19 of Graduate studies in Mathematics, American Mathematical Society, 1998.
H. Brezis, Functional analysis, Sobolev spaces, and partial differential equations.</td></tr>
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