The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA621
Subject Title	Sobolev spaces and partial differential equations
Credit Value	3
Level	6
Pre-requisite/ ~~Co-requisite/ Exclusion~~	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 *(Note 1)*	Upon completion of the subject, students will 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 *(Note 2)*	*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 *(Note 3)*	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.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
(Note 4)			a	b	c
	1. Assignments	20%	✓	✓	✓
	2. Mid-term test	30%	✓	✓	✓
	3. Final Exam	50%	✓	✓	✓
	Total	100 %			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Assignment provides students with the opportunity to practice and apply what they have learned in class. Exams are designed to test students' comprehension of the subject matter. They can reveal how well students have grasped the mathematical concepts and whether they can apply them in different contexts

Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignment	31 Hrs.
	▪ Self-study	60 Hrs.
	Total student study effort	130 Hrs.

Reading List and References	1. L.C. Evans, Partial Differential Equations (Graduate Studies in Mathematics) 2nd Edition, American Mathematical Society, 2010.
	2. H. Brezis, Functional analysis, Sobolev spaces, and partial differential equations, 2011