Subject Description Form

Subject Code	AMA 611
Subject Title	Applied Analysis
Credit Value	3
Level	6
Expected background knowledge	A course in Linear Algebra and a course in Advanced Calculus. A course in Partial Differential Equations or Analysis would be highly recommended.
Objectives	To teach students how to use functional analysis to prove various existence, stability and dynamical results of solutions to partial differential equations (PDEs) arising from Physics, Biology, Geometry and Engineering.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students should be able to: a. Learn some basic functional analysis; b. Learn how to use inequalities to prove estimates; c. Prove existence and analyze qualitative features of solutions to PDEs; d. Analyze stability and dynamics of solutions to PDEs.
Subject Synopsis/ Indicative Syllabus	*Basic functional analysis* Banach and Hilbert Spaces; L**p** spaces; Sobolev spaces; inequalities; linear operators and spectrum (discrete and continuous); Compactness. *Fixed point theorems and applications* The contraction mapping; local and global well-posedness;

	Gateaux and Frechet derivatives; implicit and inverse function theorems; applications to PDEs arising from Physics, Biology, Geometry and Engineering. *Variational Calculus* Functionals; constraints and Lagrange multipliers; minimization by direct methods; saddle points and the Mountain Pass Lemma; Hamiltonian equations.
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 assignments. In addition, tutorials will be spent discussing some possible topics for the mini projects.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignments	25%	✓	✓	✓	✓
2. Project and presentation	25%	✓	✓	✓	✓
3. Final Exam	50%	✓	✓	✓	✓
Total	100 %				

The project must be pre-approved by the instructor.

Continuous assessment comprises of assignments and project.

A written examination is held at the end of the semester.

Student Study Effort	Class contact:	

Expected	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignments ▪ Project	30 Hrs. 30 Hrs.
	▪ Self-study	31 Hrs.
	Total student study effort	130 Hrs.
Reading List and References	M. Reed and B. Simon. Methods of Modern Mathematical Physics: Vol. I: Functional Analysis. Academic Press, 1972. E. H. Lieb and M. Loss. Analysis, Graduate studies in Mathematics. American Mathematical Society, Vol. 14, 2nd ed. 2001. G. B. Folland. Real Analysis: modern techniques and their applications. Wiley, New York, 1984. R. C. McOwen. Partial Differential Equations: methods and applications. Prentice Hall, 1996. L. C. Evans. Partial Differential Equations, volume 19 of Graduate studies in mathematics. American Mathematical Society, 1998. P. D. Hislop and I. M. Sigal. Introduction to spectral theory, Vol. 133 of Applied Mathematical Sciences. Springer Verlag, 1996. S. Gustafsson and I.M. Sigal. Mathematical Concepts of Quantum Mechanics. Springer Verlag, 2003.	