Subject Description Form

Subject Code	ME6601
Subject Title	Advanced Engineering Mathematics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Prerequisite: Fundamental knowledge on vector and space, normed space, inner product, series, convergence etc.
Objectives	The subject aims at: 1. to equip students with fundamental concepts, definitions and theories of Banach spaces, Hilbert spaces, and their properties; 2. to introduce students with advanced knowledge of normed spaces, linear operators, and their applications to such as integral and differential equations
Intended Learning Outcomes	Upon satisfactory completion of the subject, students are expected to achieve the following outcomes: a. Understand Hilbert space and relating space concepts, and be able to illustrate them using examples in your research area; b. Use some vector theories/methods to solve a mathematical problem; c. Describe the main properties of the Hilbert space and understand the potential applications; d. Relate the knowledge of normed spaces and operators in Hilbert space to your research topics and apply them to integral and differential equations etc.
Subject Synopsis/ Indicative Syllabus	1. Normed vector spaces: Concepts, notations and methods in vector space theory; Vector spaces and properties; Normed spaces and basic theorems; Banach spaces and fundamental theory; Linear mappings and properties; Contraction mappings and the Banach fixed point theorem 2. The Lebesgue Integral: Step functions; Lebesque integrable functions; The space $L^1(R)$; The space $L^p(R)$ 3. Hilbert spaces and orthonormal systems: Inner product spaces; Hilbert spaces; Orthogonal and orthonormal systems; Projection theorem 4. Linear operators on Hilbert spaces: Bilinear functional and quadratic forms; Adjoint and self-adjoint operators; Invertible, normal, isometric and unitary operators; Positive, projection and compact operators; Eigenvalues and eigenvectors 5. Application issues (selective): Method of successive approximations; Ordinary differential equations and differential operators; or The Fourier transform
Teaching/Learning Methodology	This subject will be taught via lectures, tutorials, mini-projects and case studies. Tutorials, mini-projects and case studies will be conducted in small groups to facilitate discussions.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Continuous Assessment	60%	√	√	√	√
2. Final	40%	√	√	√	
Total	100%				

Student Study Effort Expected

Class contact:	
▪ Lecture	39 Hrs.
Other student study effort:	
▪ Precepts or Tutorials	31 Hrs.
▪ After-class reading	34Hrs.
Student study effort expected	104 Hrs.

Reading List and References

1. Antosik, P., and Swartz, C., *Matrix Methods in Analysis*, Springer-Verlag, Berlin, latest edition.
2. Balakrishnan, A.V., *Applied Functional Analysis*, Springer-Verlag, New York, latest edition.
3. Herman J. Bierens, *Hilbert Space Theory and Its Applications to Semi-Nonparametric Modeling and Inference*, Pennsylvania State University, latest edition.
4. Lokenath Debnath, Piotr Mikusinski, *Introduction to Hilbert Spaces with Applications*, Elsevier Academic Press, latest edition.