數學系課程核心教材內容

課程名稱：(中文）微分方程數值方法 (英文）Numerical Methods for Differential Equations				開課單位	學士班
				課程代碼	2103522
學分數	3	必/選修	選	開課年級	三

教學目標： Introduce numerical algorithms and basic error analysis for solving the ordinary differential equations together with theory of interpolation and approximation, numerical differentiation and integration.

課程概述：interpolation and approximation, numerical differentiation and integration, numerical methods for initial value problems

先修科目或先備能力：微積分、線性代數、微分方程、電腦程式能力

建議參考書目	Grasselli, *Numerical Mathematics*, Narosa Book Distributors Pvt Ltd, 2008 Burden and Faires, *Numerical Analysis*,8th ed., Thomson Brooks, 2005 Suli, *An Intro. to Numerical Analysis*, Cambridge University Press, 2006 Sauer, *Numerical Analysis*,2006 Atkinson and Kendall, *Elementary numerical analysis*.John Wiley, 2005

課程大綱

單元主題	內容綱要	上課週數
Programming review*	C/C++ for numerical computing	1-2*
Error and Computer Arithmetics*	floating-point numbers*, definitions and sources of errors, propagation of errors*	1-2*
Interpolation and Approximation	polynomial interpolation, error formula, spline interpolation, least-squares approximation*, Chebyshev polynomials*	3-4
Numerical Integraion and Differentiation	Trapezoidal, Simpson and midpoint rules, error formulas, Gaussian quadratures, numerical differentiation, Richardson extrapolation*	3
Numerical Methods for ODEs	Solvability theory, Euler's method and convergence analysis, numerical stability, simple implicit methods, Taylor series method, Runge-Kutta methods*, multistep methods*, system of differential equations	4-6
Applications	least-squares data fitting, finite difference method for two-point boundary value problems*	1-3

*: optional topics