

數學系課程核心教材內容

課程名稱：(中文) 數值常微分方程 (英文) Numerical Ordinary Differential Equations			開課單位	應數碩博班
			課程代碼	2105522
學分數	3	必/選修	選	開課年級
一				
<p>教學目標：This course focus on the analysis and algorithms for numerical approximations of differential equations. Students learn to identify the types of problems that require numerical techniques for their solutions. They also learn typical techniques for estimating error bounds for the approximations.</p> <p>課程概述：</p> <p>先修科目或先備能力：Differential Equations, Undergraduate Analysis</p>				
建議參考書目	<ol style="list-style-type: none"> 1. Kindcaid & Cheney, <i>Numerical Analysis: Mathematics of Scientific Computing</i>, 3rd ed., Brooks Cole, 2002 2. Bradie, <i>A Friendly Introduction to Numerical Analysis</i>, Pearson, 2006 3. Dormand, <i>Numerical Methods for Differential Equations</i>, CRC Press, 1996 4. Shampine, <i>Numerical Solutions of Ordinary Differential Equations</i>, Chapman & Hall, 1994 			

課程大綱

單元主題	內容綱要	上課週數
Computer Arithmetic*	Floating-Point numbers and Roundoff error, Loss of Significance, Errors	1-2*
Solution of System of Nonlinear Equations	Bisection method, Newton's method, Secant method, Fixed point iteration, Horner's Algorithm	2-3
Interpolation and Approximation	polynomial interpolation, Hermite interpolation, spline interpolation, B-splines*, best approximation*, orthogonal polynomials	3-4
Numerical Differentiation and Integration	Richardson extrapolation, theory of Gaussian quadrature, Romberg integration, Euler-Maclaurin formula*	3
Numerical Solution of Ordinary Differential Equations	Existence and uniqueness for IVP, Taylor-series method, Runge-Kutta and Runge-Kutta-Fehlberg methods, step-size control, dense output*, multistep methods, stability and stiffness, stiff solvers*, global error estimation*, shooting method for BVP*	5-7

*: optional