

數學系課程核心教材內容

課程名稱：(中文) 偏微分方程數值方法(I) (英文) Numerical Methods for Partial Differential Equations (I)				開課單位	應數碩博班
				課程代碼	2105515
學分數	3	必/選修	選修	開課年級	一
<p>教學目標：教導學生明瞭解偏微分方程的數值方法、理論基礎與誤差分析，以及電腦程式實作，期使學生對於用數值方法解各類的偏微分方程式有通盤的瞭解。</p> <p>課程概述：基礎偏微分方程式數值解與數值分析概述、parabolic與elliptic類型偏微分方程式的數值方法。</p> <p>先修科目或先備能力：numerical analysis, numerical linear algebra, numerical ordinary differential equations, some programming experience</p>					
建議參考書目	<ol style="list-style-type: none"> 1. J. W. Thomas, <i>Numerical Partial Differential Equations: Finite Difference Methods</i>, Springer, 1998 2. J. W. Thomas, <i>Numerical Partial Differential Equations: Conservation Laws and Elliptic Equations</i>, Springer, 1999 3. W. F. Ames, <i>Numerical methods for partial differential equations</i>, 3rd ed., Academic Press, 1992 4. G D. Smith, <i>Numerical Solution of Partial Differential Equations: Finite Difference Methods</i>, 3rd ed., Oxford University Press, 1986 				

課程大綱

單元主題	內容綱要	上課週數
Fundamental Ideas	Typical problems, classification of PDEs, introduction to discretization techniques, stability and convergence of the numerical methods	2-4
Parabolic Equations	Simple explicit and implicit methods, Fourier stability method, matrix stability analysis, error analysis, variable coefficients problems, method of lines, parabolic equations in several space variables, weighted residual methods and finite element methods*, nonlinear problems*	5~8
Elliptic Equations	Finite difference schemes for 2-D and 3-D Poisson equations, direct methods, sparse matrix techniques*, point iterative methods, convergence and acceleration of point iterative methods, block iterative methods*, alternating direction methods	4~6

*: optional

數學系課程核心教材內容

課程名稱：(中文) 偏微分方程數值方法(II) (英文) Numerical Methods for Partial Differential Equations (II)			開課單位	應數碩博班
			課程代碼	2105516
學分數	3	必/選修	選修	開課年級
一				
<p>教學目標：教導學生明瞭解偏微分方程的數值方法、理論基礎與誤差分析，以及電腦程式實作，期使學生對於用數值方法解各類的偏微分方程式有通盤的瞭解。</p> <p>課程概述： elliptic與hyperbolic類型偏微分方程式的數值方法</p> <p>先修科目或先備能力： numerical analysis, numerical linear algebra, some programming experience</p>				
建議參考書目	<ol style="list-style-type: none"> 1. J. W. Thomas, <i>Numerical Partial Differential Equations: Finite Difference Methods</i>, Springer, 1998 2. J. W. Thomas, <i>Numerical Partial Differential Equations: Conservation Laws and Elliptic Equations</i>, Springer, 1999 3. W. F. Ames, <i>Numerical methods for partial differential equations</i>, 3rd ed., Academic Press, 1992 4. G D. Smith, <i>Numerical Solution of Partial Differential Equations: Finite Difference Methods</i>, 3rd ed., Oxford University Press, 1986 			

課程大綱

單元主題	內容綱要	上課週數
Elliptic Equations	Finite elements methods for Poisson equations, conjugate gradient method, PCG, preconditioning and preconditioners, indefinite problems*	2~4
Hyperbolic Equations	Typical problems, method of characteristics, finite differences for first-order equations, explicit and implicit methods, stability and convergence analysis, dissipation and dispersion, finite element method for wave equation*, explicit and implicit schemes for conservation laws*	5~8
Selected Topics	FFT and fast algorithms for Poisson equations*, sparse matrix techniques*, spectral methods*, domain decomposition and multilevel methods*	4~6

*: optional