國立中正大學數學系課程大綱

National Chung Cheng University Syllabus

課號 course code	2106531	班別 class number	01	全英文 授課 EMI	□是　　☑否
課程類別 course type	□人文關懷課程　　　　　□競賽專題課程　　　　□問題導向課程 ☑專題導向課程　　　　　□總整課程　　　　　　□實作課程 □其他				
課程名稱（中文） Chinese course name	應用數學方法專題				
課程名稱（英文） English course name	Selected Topics on the Methods of Applied Mathematics				
學年/學期 academic year /semester	114/2		學分 credits	3	
學系（所） department	應用數學研究所		必選修 required/selected	□必修　　☑選修	
上課時間 class hours	一 B　三 B		上課地點 classroom	數學館 307B	
教師 instructor	尤玲凰		教師 email Instructor's email	mthlhy@ccu.edu.tw	
先修科目或 先備能力 prerequisites					
課程概述 course descriptions	The aims of the course are to give a systematic account of modern perturbation methods and to show how it can be applied to differential equations (initial value problems, boundary value problems, eigenvalue problems). It includes introduction, methods of regular perturbations, methods of strained coordinates for periodic solutions, methods of matched asymptotic expansions, WKB methods, and methods of multiple scales.				
學習目標 learning objectives	Perturbation methods underlie almost all applications of physical applied mathematics, for instance, convection in porous media, fluid mechanics, celestial mechanics, traffic flow, optics, shock waves, reaction-diffusions, and nonlinear oscillations. The aims of the course are to give a systematic account of modern perturbation methods and to show how it can be applied to differential equations (initial value problems, boundary value problems, eigenvalue problems).				
教科書及參考書 textbooks and references	(1) A. H. Nayfeh, ***Introduction to Perturbation Techniques,*** Wiley Classics Library Edition Published, 2014. (2) Mark H. Holmes, ***Introduction to Perturbation Methods***, Springer-Verlag New York, Inc., 2013. (3) C. M. Bender and S. A. Orszag, ***Advanced Mathematical Methods for Scientists and Engineers***, Springer-Verlag New York, Inc., 1999. （請尊重智慧財產權，不得非法影印教師指定之教科書籍）				

教學要點概述			
教材編選 **teaching materials**	☐自製簡報(ppt)	☐課程講義	☑自編教科書
	☐教學程式	☐自製教學影片	☐其他
教學方法 **teaching methods**	☑講述	☐小組討論	☐學生口頭報告	☐問題導向學習
	☐個案研究	☐其他		
評量工具 **Evaluation tools**	☑期中考	☑期末考	☐隨堂測驗	☐隨堂作業
	☑課後作業	☐期中報告	☐期末報告	☐專題報告
	☐評量尺規	☐其他		
教學資源 **teaching resources**	☐課程網站	☐教材電子檔供下載	☐實習網站	
教師 相關訊息 **instructor's information**				

每週課程內容 **weekly scheduled contents**	
Week 1	Dimensional analysis, Order symbols
Week 2	Asymptotic approximations
Week 3	Asymptotic solutions for algebraic equations
Week 4	Asymptotic solutions for initial value problems
Week 5	Asymptotic solutions for boundary value problems
Week 6	Asymptotic solutions for linear eigenvalue problems
Week 7	Lindstedt-Poincar'e technique to initial value problems
Week 8	Method of renormalization to initial value problems
Week 9	Layer analysis to boundary value problems and to initial value problems
Week 10	Matching principles
Week 11	Higher order approximations to boundary value problems
Week 12	Higher order approximations to initial value problems
Week 13	WKB approximations to eigenvalue problems
Week 14	WKB approximations to turning point problems
Week 15	Methods of Multiple Scales (two-scale version)
Week 16	Methods of Multiple Scales (many-scale version)
Week 17	Methods of Multiple Scales to general weakly nonlinear oscillators
Week 18	Methods of Multiple Scales to recovery of WKB and boundary layer approximations

核心能力 core competencies						

應用數學系碩士班核心能力 Core competency		本課程與核心能力關聯強度 Degrees of related to core competencies				
		1	**2**	**3**	**4**	**5**
專業能力 Specific competency	**專業能力 1**：具備紮實的分析、微分方程、或數值方法等應用數學相關主題專業及進階知識					✓
	專業能力 2：具備撰寫程式語言與電腦輔助計算之優秀能力	✓				
	專業能力 3：具備發掘、分析及解決專業問題之優秀能力					✓
	專業能力 4：具備能將數學或機率與統計知識轉化為自然科學、工程或社會科學領域工作助力之優秀能力					✓
	專業能力 5：具備優秀的數理邏輯、獨立思考及科技報告寫作能力				✓	
共通能力 General Competence	**共通能力 1**：具備優秀的溝通及分工合作能力			✓		
	共通能力 2：具備良好的國際觀及終身自我學習成長之能力			✓		

註：關聯強度以五點量表標示，1 表示沒有關聯，5 表示非常有關聯。