

## 數學系課程核心教材內容

課程名稱：(中文) 應用數學方法專題 (英文) Selected Topics on the Methods of Applied Mathematics			開課單位	應數碩博班
			課程代碼	2106531
學分數	3	必/選修	選修	開課年級
碩博合開				
<p>教學目標：Perturbation methods underlie almost all applications of physical applied mathematics, for instance, in 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).</p> <p>課程概述：</p> <p>先修科目或先備能力：</p>				
建議參考書目	<ol style="list-style-type: none"> <li>1. "Introduction to Perturbation Techniques", A. H. Nayfeh</li> <li>2. "Introduction to Perturbation Methods", Mark H. Holmes</li> <li>3. "Advanced Mathematical Methods for Scientists and Engineers", C. M. Bender and S. A. Orszag</li> </ol>			

### 課程大綱

單元主題	內容綱要	上課週數
Introduction	Dimensional analysis, Order symbols, Asymptotic approximations	2
Methods of Regular Perturbations	Asymptotic solutions for initial value problems, boundary value problems, and linear eigenvalue problems	2
Methods of Strained Coordinates for Periodic Solutions	Lindstedt-Poincar'e technique, Method of renormalization, Applications to initial value problems	2
Methods of Matched Asymptotic Expansions	Layer analysis, Matching principles, Higher order approximations, Applications to boundary value problems and initial value problems	4
WKB Methods	WKB approximations, Applications to eigenvalue problems, Turning point problems	3
Methods of Multiple Scales	Two-scale version, Many-scale version, Applications to general weakly nonlinear oscillators, Recovery of WKB and boundary layer approximations	3