數學系課程核心教材內容

課程名稱：(中文）常微分方程(一) (英文）Ordinary Differential Equations (I)				開課單位	應數碩博班
				課程代碼	2105201
學分數	3	必/選修	選修	開課年級	一
教學目標：學習常微分方程的理論及分析技巧，並引導學生將其應用至相關領域。 課程概述：這是一個一學年的課程，第一學期將學習初始值問題解的存在、唯一及延拓性質，並討論多維度線性系統的相關理論，第二學期則是學習非線性問題的相關性質。 先修科目或先備能力：線性代數，高等微積分，微分方程（大學部）					
建議參考書目	S. B. Hsu, Ordinary Differential Equations with Applications, World Scientific, 2005. J. C. Hale, Ordinary Differential Equations, 2nd ed., R. E. Krieger Pub. Co., 1980. P. Hartman, Ordinary Differential Equations, Reprint, Boston :Birkhauser, 1982.				

課程大綱

單元主題	內容綱要	上課週數
Preliminary	Derivation of some initial value problems (IVP) and boundary value problems (BVP), basic properties of Banach space, Ascoli-Arzela theorem.	2
General Properties of ODEs	Local existence and uniqueness of solutions of initial value problem, Gronwall's inequality, continuation of solutions, continuous dependence of initial conditions and parameters, differentiability of initial conditions and parameters, variational system of initial value problems, differential inequalities, comparison theorem.	6~7
Linear System	Fundamental matrices, linear systems with constant coefficients, variational form of solutions, stability of two dimensional linear systems, linear systems with periodic coefficients, Floque's multiplier, Floque's theorem, Fredholm alternatives of adjoint systems.	6~7

數學系課程核心教材內容

課程名稱：(中文）常微分方程(二) (英文）Ordinary Differential Equations (II)				開課單位	應數碩博班
				課程代碼	2105202
學分數	3	必/選修	選修	開課年級	一
教學目標：學習常微分方程的理論及分析技巧，並引導學生將其應用至相關領域。 課程概述：我們將承繼上學期常微分方程（一）有關初始值解的存在與唯一性質，以及線性問題的學習，進而延伸至非線性問題的探討。我們將介紹數種較典型的研究方法，並且希望同學們能藉由探索此類問題解的存在、穩定等性質的學習過程中，進而熟練這些研究方法，進而能應用至其他的延伸問題上。 先修科目或先備能力：線性代數，高等微積分，微分方程（大學部）					
建議參考書目	S. B. Hsu, Ordinary Differential Equations with Applications, World Scientific, 2005. J. C. Hale, Ordinary Differential Equations, 2nd ed., R. E. Krieger Pub. Co., 1980. P. Hartman, Ordinary Differential Equations, Reprint, Boston: Birkhauser, 1982.				

課程大綱

單元主題	內容綱要	上課週數
Nonlinear System	Linearization of autonomous systems, variational matrices, stability of equilibria, nonlinear stability, stable and unstable manifolds, stability of orbits, linearization of orbits and maps, applications to some traveling wave equations*	4
Lyapunov Method	Invariant sets, ω-limit sets, Lyapunov functions, invariant principle, simple oscillatory of solutions*	3~4
Two Dimensional Systems	Poincare-Bendixon theorem, Bendixson's negative criterion, Dulac's criteion, Jordan curve theorem, Levison-Smith theorem, relaxation of van der Pol oscillator, Hopf bifurcation*.	3~4
Second Order Linear System	Prufer transformation, Sturm's comparison theorem, Dirac function approximation, Green's function of two-point BVPs, Fredholm alternatives for 2nd order linear equations	3
Index Theory and Brouwer Degree*	Index theory in the plane, homotopy invariance, Brouwer degree, Sard's theory, Brouwer fixed point theorem.	2

*: optional topics