數學系課程核心教材內容

課程名稱：(中文) 微積分(一) (數學系) (英文) Calculus (I)				開課單位	學士班
				課程代碼	2101001
學分數	4	必/選修	必	開課年級	一

教學目標：

(一) 主要目標：使學生清楚的了解微積分的基本概念、法則及數學證明的要求，透過各種實例的介紹，讓學生能對微積分有更多的認識，以備學生研習高等微積分、實變數函數、複變數函數、泛函、及拓樸學等科目能有充分而紮實的數量基礎。

(二) 次要目標：經由微積分的實做演算，培養學生應用微積分解決相關數學問題的能力及數學嚴密性的要求。

課程概述：(1) 函數之極限及連續概念；(2) 函數之微分、均值定理及其應用；(3) 積分概念、積分技巧及其應用；(4)超越函數。

先修科目或先備能力：無。

建議參考書目	1. "Calculus: One and Several Variables (10th edition)", by Satunino L. Salas, Garret J. Etgen, and Einar Hille. 2. "Calculus: Early Transcendental (5th edition)", by James Stewart. 3. "Calculus (9th edition)", by Bruce H. Edwards and Ron Larson.

課程大綱

單元主題	內容綱要	上課週數
Limit and Continuity	The idea of limit, $\varepsilon-\delta$ definition of limit, limit theorems, continuity, the pinching theorem-trigonometric limits, basic properties of continuous functions-intermediate value theorem, fixed point property	3
Differentiation	The derivatives, some differentiation formulas, the *d*/*dx* notation, the derivative as rate of change, differentiation of trigonometric function, implicit differentiation.	2
The Mean-Value Theorem and Applications	The mean-value theorem, increasing and decreasing functions, local extreme values, endpoint and absolute extreme value, some max-min problems, concavity and points of inflection, vertical and horizontal asymptotes, some curve sketching	2-3

Integration	An area problem, the definite integral of a continuous function, the fundamental theorem of calculus, some area problem, indefinite integral, the u-substitution, additional properties of definite integral, man-value theorems for integrals-average values, more areas.	2-3
The transcendmental functions	One-to-one functions: inverse, the logarithm functions, the exponential functions, the inverse trigonometric functions, the hyperbolic functions, exponential growth and decay	2
Techniques of integration	Integral table and review, integration by parts, powers and products of trigonometric functions, rational functions-partial fractions, numerical integration, integrals involving $\sqrt{a^2-x^2}$ ，$\sqrt{a^2+x^2}$ ，$\sqrt{x^2-a^2}$	2
Applications of the integral*	More area, volume by cross-section; discs and washers, shell method	1

*：optional topics

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<tr><td colspan="4">課程名稱：(中文) 微積分(二) (數學系)
(英文) Calculus (II)</td><td>開課單位</td><td>學士班</td></tr>
<tr><td colspan="4"></td><td>課程代碼</td><td>2101002</td></tr>
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課程概述：(1) 極座標；(2) 數列、無窮級數；(3) 多變數函數概念；(4) 多變數函數微分；(5) 二重及三重積分；(6) 線積分及面積分。

先修科目或先備能力：無。</td></tr>
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課程大綱

單元主題	內容綱要	上課週數
Polar Coordinates and Parametric Equations	Polar coordinates, area in polar coordinates, curves given parametrically, tangents to curves given parametrically, arc length	1-2
Sequences	The least upper bounded axiom, sequence of real numbers, the limit of a sequence, some important limits, the indeterminate forms (0/0, ∞/∞), improper integrals	2
Infinite series	Infinite series, the integral test, the root test, absolute and conditional convergence-alternating series, Taylor polynomials and Taylor series, power series, differentiation and integration of power series	2-3

Functions of Several Variables	Elementary examples, graphs-level curves and level surfaces, partial derivatives, open sets and closed sets, limit and continuity, equality of mixed partials	2
Gradients; Extreme Values; Differentials	Differentiability and gradient, gradients and directional derivatives, the gradient as a normal-tangent lines and tangent planes, local extreme values, absolute extreme values, maxima and minima with side conditions, differentials	3
Double and Triple Integrals	Multiple-sigma notation, the double integral, the evaluation of a double integral by repeated integrals, double integrals in polar coordinates, some application of double integration, triple integrals, reduction to repeated integrals, triple integrals in cylindrical coordinates, triple integrals in spherical coordinates, Jacobians-changing variables in multiple integrations.	3
Line Integrals and Surface Integrals*	Line integrals, the fundamental theorem for line integrals, work-energy formula, line integrals with respect to arc length, Green's theorem; parameterized surfaces, surface area, surface integrals.	2

*：optional topics