**100172101,100172101 Calculus A**

**Lecture Hours:** 192

**Credits**: 12

**Prerequisite**: None

**Course Description:**

Calculus A is a two-semester compulsory course for the undergraduates major in the general engineering (except Electronics and Communications Engineering, Computer Application Technology etc.). Through the studying of this course, students will master basic concepts, basic theory and basic computing skills of calculus. The course can cultivate students’ ability of understanding mathematical language, abstracting general problem, logical reasoning, spatial imagination and skilled computing. In addition, the course can cultivate students the ability to analyze and solve practical problem and lay fundamentals to study the follow-up courses.

**Course Outcomes:**

Upon successfully completing this course, students should be able to:

1. Understand the following concepts: limits and continuity of single-variable and multivariable functions, the derivative and partial derivative, the integral, the multiple integral, curve and surface integral, infinite series and differential equation.
2. Compute derivatives and basic integrals of functions;
3. Apply the methods of calculus to solve integrals involving integration by substitution, integration by parts and partial fraction decomposition;
4. Solve ordinary differential equations;
5. Determine the convergence of series using p-series, alternating series test, and ratio and toot tests;
6. Recognize and determine the radius of convergence and interval of convergence for power series;
7. Apply the concepts in calculus to model and solve the problems in geometry, physics and other fields.

**Course Content**

The content of calculus A includes: function, limits and continuity, single-variable calculus, ordinary differential equation, vector algebra and space analytic geometry, multivariable calculus and infinite series.

**Lectures and Lecture Hours:**

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| Lectures | Lecture Hours |
| Chapter 0 Preliminaries  Section1 Set and Interval  Section 2 Function | 4 |
| Chapter1 Limit and Continuity of a function  Section 1 The Limit of Sequence  Section 2 The Limit of a Function  Section 3 Calculating Limits using the Limit Laws  Section 4 Two Important Limits  Section 5 The Infinitesimal and Infinity  Section 6 The Continuity of a Function  Section 7 The Comprehensive Example | 16 |
| Chapter 2 Derivative and Differentiate  Section 1 The Concept of Derivative  Section 2 Differentiation Rules and Basic Differentitant Formulas  Section 3 Implicit Differentiation and Parameter Equation Derivation  Section 4 Higher order derivative  Section 5 The Differentiation of Functions  Section 6 The Comprehensive Example | 12 |
| Chapter 3 The Mean Value Theorem and Application of Differentiation  Section 1 The Mean Values Theorem  Section 2 L’Hoptital’s Rule  Section 3 Taylor Formula  Section 4 Studying on the Property of Function  Section 5 Curvature of Curve  Section 6 The Comprehensive Example | 20 |
| Chapter 4 Single Variable Integral Calculus  Section 1 The Concept and Properties of Definite Integral  Section 2 Fundamental Theorem of Calculus  Section 3 Indefinite Integrals  Section4 Calculation of definite Integral  Section5 Improper Integral  Section6 Geometric Application of Definite Integral  Section7 Physical Application of Definite Integral  Section8 The Comprehensive Example | 24 |
| Chapter 5Ordinary Differential Equations  Section1 The Concept of Differential Equations  Section 2 First-order differential Equations  Section 3 Higher Order Differential Equation with Reduced Order  Section 4 The structure for the solutions of Linear Ordinary Differential Equations  Section 5  Homogeneous Linear Ordinary Differential Equation with  Constant Coefficients  Section 6  non-Homogeneous Linear Ordinary Differential Equation with  Constant Coefficients  Section 7 Systems of Linear Ordinary Differential Equation with  Constant Coefficients  Section8 Mathematical Modeling – The application of Differential Equations  Section 9 The Comprehensive Example | 20 |
| Chapter6 Vector Algebra and Space Analytic Geometry  Section1 Rectangular coordinate System in Space  Section2 Vector and Its Linear Operation  Section3 Product of Vector  Section4 Planar Equation  Section5 Space Straight Line Equation  Section6 Space Surface and Space Curve  Section7 Quadric Surfaces  Section8 The Comprehensive Example | 16 |
| Chapter 7 Multivariable Differential Calculus  Section 1 Limit and Continuity of Multivariate Function  Section 2 Partial Derivatives  Section 3 Total Differentiation  Section 4 Differential Method of Composite Function and Implicit Function  Section5 Directional Derivative and Gradient  Section 6 The Application of Differential Calculus in Geometry  Section7 Taylor Formula of Two Function  Section8 The Extreme Value of Multiple Function  Section9 The Comprehensive Example | 20 |
| Chapter8 Multiple Integrals  Section1 The Concept and Properties of Multiple Integrals  Section2 Computation of Double Integrals  Section3 Computation of Triple Integrals  Section4 Application of Multiple Integrals  Section5 Substitutions in Multiple Integrals  Section 6 The Comprehensive Example | 18 |
| Chapter9 Line Integrals and Surface Integrals  Section1 Line Integrals of The First Type  Section2 Line Integrals of The Second Type  Section3 Green’s Theorem, The Condition of Plane Curve Integral and Path Independent  Section4 Surface Integrals of The First Type  Section5 Surface Integrals of The Second Type  Section6 Gauss Formula and Divergence  Section7 Stokes Formula and rotation  Section 8 The Comprehensive Example | 20 |
| Chapter 10 Series  Section 1 The Concept and Properties of Constant series  Section 2 Positive Series  Section 3 Arbitrary Series  Section 4 Power Series  Section 5 Representations of Functions as Power Series  Section6 Fourier Series  Section7 The Comprehensive Example | 22 |

**Grading:**

Homework 10%

In class Presentation 10%

Quizzes and Tests 20%

Final Exam 60%

**Text & Reference Book:**

**The textbook for this course**

[1]Ruiqi Zhang, Yihong Chen, Calculus(I) , 2008, ISBN 7-111-17259-0. China Machine Press.

[2]Ruiqi Zhang, Yihong Chen, Calculus(II) , 2008, ISBN 7-111-18326-6. China Machine Press.

**Reference Books**

[1]Jingzhong Mao, Advanced Mathematics(I), 2008, ISBN 978-7-04-023603-3, Higher Education Press.

[2]Jingzhong Mao, Advanced Mathematics(II), 2008, ISBN 978-7-04-023604-0, Higher Education Press.

[3]Department of Mathematics of Tongji University, Advanced Mathematics(I), 5thed, 2003, ISBN7-04-010820-8, Higher Education Press.

[4]Department of Mathematics of Tongji University, Advanced Mathematics(II), 5thed, 2003, ISBN7-04-010821-6, Higher Education Press.