CUHK (SZ)
Course Outline

1. Course Identity

A. Course as listed in CUHK (SZ)

The information in this block should be exactly as approved by CUHK Senate. In case there are any differences, please explain in the table below.

Course code	MAT2006
Course title (English)	Elementary Real Analysis
Course title (Chinese)	基础实分析
Units	3
Description (English)	This course places its main weight on rigorous mathematical analysis in single variable calculus. It pays special attention to developing the students' ability to present mathematical results logically and thought patterns adequate for the precision required in higher mathematics. Topics include naive set theory, theory of real numbers, sequences and series, differentiable calculus, and Riemann integrals.
Description (Chinese)	本课程着重讲授单变量微积分的严格数学分析，特别注重培养学生逻辑表达数学结果的能力和足以满足高等数学精确性所需的思维方式。课程的内容包括：朴素集合论、实数理论、数列与级数、微分以及黎曼积分。

B. Corresponding course in CUHK

Please give details of the *closest* corresponding course in CUHK (as approved by CUHK Senate and listed in course list). If the course in SZ maps to more than one course in CUHK, please make multiple copies of the block below.

Course code	MATH2050
Course title (English)	Mathematical Analysis I
Course title (Chinese)	数学分析一
Units	3
Description (English)	This course is intended to provide conceptual understanding in the theory of functions of one variable. Topics include: real numbers, real valued functions, elementary set theory, limits of sequences and continuous functions.
Description (Chinese)	

2. Prerequisites / Co-requisites

Please state prerequisites and co-requisites, in terms of courses in CUHK (SZ)* or any other requirements (e.g., having taken certain subjects in high school).

(* Because course codes may not yet be stable, please provide both course code and course tile.)

A. Prerequisites

MAT1001 Calculus I & MAT1002 Calculus II or
MAT1011 Calculus (Extended) I & MAT1012 Calculus (Extended) II

B. Co-requisites

None.

3. Learning Outcomes

Knowledge:

a) Students will understand the concept and theory of set and real numbers.
b) Students will understand the concept of convergence, limit and continuity.
c) Students will understand the content of differentiable calculus
d) Students will understand the content of Riemann integrals

Skills

Generic:

e) Apply different logical connectives and techniques of proof to present mathematical results in a logical and coherent fashion Students will be able to evaluate integrals by residues.
f) Apply the concepts of topics as outlined in "course content" to prove theorems in univariate calculus.
g) Develop abstract concepts in advanced mathematics, and develop thought patterns adequate for the precision required in higher mathematics.

Valued/Attitude:

h) Students will realize the insufficiency of an informal understanding of the subject calculus, and understand why a more rigorous study is needed.
i) Students will be more vigilant in the power of abstraction in mathematics.

4. Course syllabus

Naive set theory, real numbers, sequences and series, differentiable calculus, Riemann integrals, Riemann-Stieltjes integrals.

5. Assessment Scheme

Component/ method	% weight
Assignments	20
Mid-term test	30
Final exam	50

6. Descriptor

Grade	Overall course

Grade	Overall course
A	Demonstrates the ability to achieve all the learning outcomes in this course and be able to apply the principles in solving problems in novel situations, in a manner that would surpass the normal expectation at this level, and typical of standards that may be common at higher levels of study or research. Has the ability to express the synthesis of ideas or application in a clear and cogent manner.
A-	Demonstrates the ability to state and apply the principles or subject matter learnt in the course to familiar and standard situations in a manner that is logical and comprehensive. Has the ability to express the knowledge or application with clarity.
B	Demonstrates the ability to state and partially apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is usually logically persuasive. Has the ability to express the knowledge or application in a satisfactory and unambiguous way.
C	Demonstrates the ability to state and apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is not incorrect but is somewhat fragmented. Has the ability to express the separate pieces of knowledge in an unambiguous way.
D	Demonstrates the ability to state and sometimes apply the principles or subject matter learnt in the course to some simple and familiar situations in a manner that is broadly correct in its essentials Has the ability to state the knowledge or application in simple terms.
F	Unsatisfactory performance on a number of learning outcomes, OR failure to meet specified assessment requirements.

7. Feedback for evaluation

- CTE

8. Reading

A. Required

[1] Stephen Abbott, *Understanding Analysis*, Springer-Verlag, New York, 2015.

B. Recommended

[2] Terence Tao, *Analysis I and II*, 3rd ed., Hindustan Book Agency, New Delhi, 2015.

[3] Walter Rudin, *Principles of Mathematical Analysis*, 3rd ed., McGraw-Hill, New York, 1976.

[4] Vladimir A. Zorich, *Mathematical Analysis*, 2nd ed., Springer, Berlin Heidelberg, 2015.

9. Course components

Activity	Hours/week
Lectures	3
Tutorial	1
Readings & Assignments	6

10. Indicative teaching plan

Week	Content/ topic/ activity
1	Preliminaries: naive set theory, cardinality, functions
2	Real Numbers: Cauchy sequence, Dedekind's cut, algebraic properties
3	Sequences and Series: limits, limsup and liminf, Stolz theorem
4	Real Numbers: Heine-Borel, Bolzono-Weierstrass, etc.
5	Topology of Real Numbers
6	Continuity: limit of function, intermediate value theorem
7	Differentiable Calculus: derivatives, mean-value theorem
8	Baire Category: no-where differentiable continuous functions
9	Sequences and Series of Functions: uniform convergence
10	Taylor Series: remainders, applications.
11	Integration: definition, mean-value theorem, fundamental theorem of calculus
12	Riemann-Stietjes integral
13	Inequalities: Cauchy-Schwarz, Minkowski, Hölder, Young

11. Implementation plan (2019-20)

The implementation plan may vary from year to year. Please indicate expected enrolment, and number of sections.

Expected enrolment: 120
Number of lecturing sections: 1
Number of tutorial sections: 3

12. Approval

Has the course title been included in the programme submission approved by CUHK Senate? Are there any differences?

Yes.

Have the details (as in this document) been approved at School or other level in CUHK (SZ)?

Yes

13. Any other information

N.A.

14. Version date

Version number	3
As of (date)	July 28, 2020