Acknowledgement

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next on this site.

Course Information

Course Title	Course Code Number	Credit Value
Applied Complex Analysis	MATH 302:201	3

Time and Room: MWF 12-1pm in LSK 200

Prerequisites

One of MATH 200, MATH 217, MATH 226, MATH 253, MATH 263
and one of MATH 215, MATH 255, MATH 256, MATH 265

Corequisites

One of MATH 256, MATH 257, MATH 316.

Contacts

Course Instructor(s)	Contact Details	Office Location	Office Hours
Sven Bachmann	By email: sbach@math.ubc.ca	MATH 228	Mon 4-5

Other Instructional Staff

TA: Li Wang, lwang@math.ubc.ca

Course Structure & Learning Outcomes

The three weekly lectures aim at a non pedantic and enlightening exposition of the central mathematical results, illustrated by few examples. They are complemented by the homework exercises which are an essential part of the learning process. Active participation through questions during the lectures is encouraged.

Students will further benefit from reading the corresponding material in the textbook, which provides a slightly different perspective on the topics and covers many more examples.

Having reviewed basics of complex numbers and the complex plane $\mathbb{C}$, this course concentrates on analytic aspects of functions defined on $\mathbb{C}$ and taking values in $\mathbb{C}$. It will cover differentiation and integration and focus on the fundamental difference between the plane $\mathbb{R}^2$ and the complex plane $\mathbb{C}$. Complex functions are ubiquitous in science and engineering, in particular through the computational power associated with complex integration as well as in understanding the solutions of differential equations.

Schedule of Topics

1. Preliminaries
   - Complex numbers
   - Polar form, powers and roots
   - Sets in the complex plane and mappings
2. Functions
   - Continuity
   - Differentiability and the Cauchy-Riemann equations
   - Holomorphic functions
   - Power series
   - The exponential and logarithm functions
3. Integration
   - Contours
   - Integration along contours
   - Primitives
4. Cauchy's theorem and applications
   - Cauchy's theorem and Cauchy's integral formulas
   - Toy contours and evaluation of integrals
   - Liouville's theorem
   - The fundamental theorem of algebra
5. Meromorphic functions
   - Zeros and poles
   - Laurent series
   - The residue formula
   - Evaluation of integrals
   - The argument function and the winding number

6. The Fourier transform
   - Fourier and inverse Fourier transforms
   - Elementary properties
   - Application to differential equations

Learning Materials

There will be weekly lecture notes posted on the course's website. The weekly homework assignments and their solutions will be posted there. All important announcements will be communicated through the website.

The only use of Canvas is to communicate the grades of homework sets and the midterm exam.

We will not follow any textbook explicitly. The reference textbook is
Fundamentals of Complex Analysis: with Applications to Engineering and Science by E. Saff and A.D. Snider
There are many other excellent elementary texts, such as
Princeton Lectures in Analysis II: Complex Analysis by E.M. Stein and R. Shakarchi
Complex Analysis by E. Stuart and D. Tall

Assessments of Learning

Update on March 23, 2020.
This grading scheme below has been imposed by the Faculty of Science and supersedes the grading schemes below. There will be a final exam. The course grade G is computed out the homework grade g_{HW} (dropping the lowest homework score) and the midterm grade g_M and the final grade g_F as

$$G = \max\{0.05g_F + 0.55g_M + 0.4g_{HW}, 0.3g_F + 0.4g_M + 0.3g_{HW}\}.$$

Update on March 18, 2020.
There will be no final exam. The final grade G is computed out the homework grade g_{HW} (dropping the lowest homework score) and the midterm grade g_M as

$$G = \max\left\{\frac{1}{2}(g_{HW} + g_M), 50\%\right\}.$$

There will be

1. weekly homework assignments made available on Fridays and due a week later,
2. one midterm exam taking place in class on February 24, lasting 50 minutes,
3. one final exam to be scheduled in the exam period.

Cheating will not be tolerated.

All electronic devices must be turned off and put away. That includes smart phones, tablets, computers, smart watches and calculators.

Final Grade

The final grade is computed as such:

Homework: 20%; Midterm: 30%; Final: 50%.

In calculating your score for the homework, I will drop your lowest score. These include missed assignment.

Missing the midterm: There is no make-up midterm. Missing the midterm for a valid reason normally results in the weight of that midterm being transferred to the final exam and the homework, resulting in HW: 30%, F: 70% . Examples of valid reasons include illness and travel to play a scheduled game for a varsity team. Examples of reasons that are not valid include conflicts with personal travel schedules or conflicts with work schedules. Any student who misses a test is to present to their instructor the Department of Mathematics self-declaration form for reporting a missed assessment to their instructor within 72 hours of the midterm date.

You must finish a significant amount of term work in order to pass.

In the case of the final exam, the students should contact the Department of Mathematics and the missed final will be handled in a formal way.

On submitted work:

All assertions require an argument unless the problem states otherwise. No matter the operative word ('find', 'solve', 'establish', 'calculate', 'determine',...), you must justify your answer.
Written work should be presented carefully, in complete English sentences, and with sufficient detail. A correct sequence of formulas will only receive partial credit, an unstructured cloud of formulas and incoherent text will receive none.
When writing your solution to the problems, keep the following in mind: 'What is conceived well is expressed clearly, And the words to say it arrive without difficulty.' (N. Boileau, 1674) This in turns means that if you find yourself unable to express what you have in mind, then your ideas are most probably not clear yet.

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and

for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website.

Other Course Policies

You are not allowed to use any of {cellphones, tablets and computers} during the lectures. Recording of the lectures and taking photos during or after the lectures is prohibited. If you have special needs requiring a technological assistance, please briefly notice the instructor.

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Version: March 23, 2020