UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: January 1994
REVISED COURSE IMPLEMENTATION DATE: September 2020
COURSE TO BE REVIEWED (six years after UEC approval)**:** January 2026
Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: MATH 322

Number of Credits: 3 Course credit policy (105)

Course Full Title: Complex Variables

Course Short Title:

(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science

Department (or program if no department): Mathematics & Statistics

Calendar Description:

Introduces complex analysis and its applications. Topics include the algebra of complex numbers, geometry of the complex plane, analytic functions, contour integration, complex power series, residue theory, and further topics such as conformal mappings, fractals, and stereographic projections, as time permits.

Prerequisites (or NONE):	MATH 211 and one of MATH 112 with a C or better or MATH 118 with B or better.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number:

Cross-listed with:

Dual-listed with:

Equivalent course(s):

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar hours	50
Tutorials/workshops	
Supervised laboratory hours	
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**50**

Labs to be scheduled independent of lecture hours: ☐ No ☐ Yes

Special Topics *(Double-click on boxes to select.)*

This course is offered with different topics:

☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study

If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*

☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit

Transfer credit already exists: *(See **bctransferguide.ca**.)*

☐ No ☒ Yes

Submit outline for (re)articulation:

☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System

☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 36

Expected Frequency of Course Offerings:

Every other year *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Ian Affleck	**Date approved:**	
Faculty Council approval	**Date approved:**	October 4, 2019
Dean/Associate VP: Lucy Lee	**Date approved:**	October 4, 2019
Campus-Wide Consultation (CWC)	**Date of posting:**	n/a
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	January 31, 2020

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Perform arithmetic operations on complex numbers using Cartesian, polar, and exponential representations of those numbers;
2. Solve equations through manipulation of algebraic expressions, using Cartesian, polar, and exponential representations of complex numbers;
3. Use definitions to explore the limits, continuity, and analyticity of complex functions;
4. Develop results regarding the Cauchy-Riemann equations and harmonic functions, in both Cartesian and exponential form;
5. Compute complex powers and complex-base logarithms of complex numbers;
6. Express trigonometric, hyperbolic trigonometric, inverse trigonometric, and inverse hyperbolic trigonometric functions using exponential and logarithmic functions;
7. Reason about the properties and inter-relationships of elementary functions of complex variables, and analyze their behavior on appropriate regions of the complex plane;
8. Calculate integrals along contours in the complex plane, both from the definition and using independence of path or antidifferentiation, as appropriate;
9. Explain the Independence of Path Theorem and its relationship to the Cauchy Integral Theorem;
10. Establish and apply consequences of Cauchy's Integral Formula;
11. Compute Laurent series for complex-valued functions and use Laurent series expansions to calculate integrals;
12. Use the Residue Theorem to evaluate certain real integrals, such as trigonometric integrals and some improper integrals;
13. Demonstrate the ability to formulate proofs of gradually increasing levels of sophistication;
14. Read short segments of new material on their own and use what they learn to solve various applied problems.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lectures may be interspersed with in-class problem sessions. Evaluation includes assignments, quizzes, term tests, and a three-hour final exam. Mathematical software may be used to help students explore concepts.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Saff & Snider	Fundamentals of Complex Analysis with Applications to Engineering and Science, 3rd ed	☐	Prentice Hall	2003
2.			☐		
3.			☐		
4.			☐		
5.			☐		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	25%	Field experience:	%	Portfolio:	%
Midterm exam:	%	Project:	%	Practicum:	%	Other:	%
Quizzes/tests:	35%	Lab work:	%	Shop work:	%	Total:	100%

Details (if necessary): The weighting of components may vary amongst instructors and across years, but there must be at least two tests and the final exam must be comprehensive. Students must achieve at least 40% on the final exam in order to pass the course.

Typical Course Content and Topics

1. Complex arithmetic, basic geometry, algebra: definitions, modulus, conjugate, Cartesian, polar and exponential forms, powers and roots
2. Limits, continuity, analyticity of functions; the Cauchy-Riemann equations, harmonic functions
3. Elementary functions: polynomial, rational, exponential, logarithmic, trigonometric and inverses, hyperbolic trigonometric and inverses
4. Complex integration: contour integrals, Cauchy's integral theorem, Cauchy's integral formula
5. Complex series: properties of power series, Taylor and Laurent series, singularities
6. Residue theory: residues and poles, the residue theorem and applications

Optional, as time permits: elementary properties of conformal mapping; the Riemann sphere and stereographic projection; Julia and Mandelbrot sets.