MATH-104 – Integral Calculus

University Arts and Science

Effective Term & Year: Fall 2022
Course Outline Review Date: 2025-03-01

Program Area: Math and Sciences

Description:

Students work with polynomial, rational, logarithmic, exponential, trigonometric, inverse, and hyperbolic functions. They will learn integration techniques (substitution, parts, partial fractions, trigonometric substitution, numerical methods), applications of integration (volumes of revolution, work, fluid, force, surfaces, arc length, and centroids); l'Hôpital's rule and improper integrals; sequences and series; convergence tests (divergence, integral, comparison, limit comparison, ratio, root, and alternating series tests), Power, Maclaurin and Taylor series, differential equations, polar curves (common graphs, slopes, area, arc length, and conics) and parametric equations (higher order derivatives, area, and arc length). Calculus is a necessary step in any career in the sciences including Biology, Chemistry, Commerce, Computer Science, Engineering, Geology, Mathematics, Medicine, and Physics. It is also useful in any field which uses Statistics to analyze data.

Program Information:

This course is a required course for a Bachelor of Science degree in most universities. It can be used as three of the six units in Calculus which are required for an Associate of Science degree at College of the Rockies.

Delivery Methods: On-campus (Face-to-Face), Online

Credit Type: College of the Rockies Credits

Credits: 3

Course type/s: Sciences

Instructional Activity and Hours:

Activity	Hours
Classroom, Directed Studies or Online Instruction	45
Seminar/Tutorials	
Laboratory/Studio	15
Practicum/Field Experience	
Co-op/Work Experience	
Other	
Total	60

Course Requisites:

- Complete all of the following
    - Completed the following:
        - MATH103 – Differential Calculus (3)
    - Or a score of 4 or 5 on the AP Calculus.

Flexible Assessment: Yes

In some cases students may be able to apply for recognition of prior learning outside the classroom. This flexible assessment process provides equivalent course credit. It is a rigorous process that may include external evaluation, worksite assessment, demonstration, standardized test, self-assessment, interview, products/portfolio, and challenge exam, or other measures as appropriate. Tuition fees apply. Contact an education advisor for more information.

Course Transfer Credit:

For information about receiving transfer credit for courses taken at other BC institutions, please see http://www.bctransferguide.ca. All requests for course transfer credit from institutions in BC or elsewhere should go to the College of the Rockies Enrollment Services office.

Textbook Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Guishard, D. *Calculus – Early Transcendentals – An Open Text,* Lyryx Learning, Creative Commons License (CC BY-NC-SA), 2018

Weir, Maurice D., Hass, Joel, and Giordano, Frank R., *Thomas' Calculus, Early Transcendentals,* 11th Edition.

Please see the instructor's syllabus or check COTR's online text calculator
https://textbook.cotr.bc.ca/ for a complete list of the currently required textbooks.

Learning Outcomes:

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

- demonstrate an expansion of his/her previous knowledge of algebra and differential calculus;
- employ a variety of formal problem solving methods;
- formalize his/her own methods of problem solving;
- work with algebraic and transcendental functions, such as logarithmic, exponential, trigonometric, hyperbolic, and inverse trigonometric functions;
- integrate functions, using a variety of techniques (parts, substitution, trig. substitution, partial fractions, numerical, etc.);
- use integration techniques to find volumes of solids of revolution, surfaces of revolution, arc length, centroids, work, and fluid forces;
- use l'Hôpital's rule to aid in evaluating improper integrals;
- work with sequences and series, and employ a variety of tests to determine the convergence of series;
- work with, integrate, differentiate, and apply Taylor, Maclaurin, and Power series;
- solve first order differential equation, either by separating the variables or by using an integrating factor;
- draw slope fields and apply Euler's method;
- work with polar coordinates, graph polar curves, find rates of change, areas, and arc length of polar curves;
- express conic sections as polar curves;
- differentiate, find areas, and arc length of parametric equations;
- use technology (Maple) as a tool in the problem solving process; and
- reflect on the usefulness of mathematics by reading about, interpreting, and finding applications for all of the concepts studied.

This course should help students:

- use written and oral communication skills effectively, employing methods appropriate to message and context;
- think clearly and critically, fusing experience, knowledge and reasoning into considered judgment;
- identify, interpret, and solve problems, effectively implementing and evaluating proposed strategies;
- use organizational, problem solving, and critical thinking skills;

- develop an ability to work both independently and in groups;
- develop an ability to transfer knowledge to new contexts;
- practice comprehending and interpreting abstract materials from text; and
- appreciate of the importance of persistence, attitude and energy.

Course Topics:

- Review of integration
- Techniques of integration: integration by parts, partial fraction decomposition, trigonometric integrals, trigonometric substitutions, numerical integration
- Applications of integration: volumes, lengths, moments and centres of mass, surface area, work, fluid pressure
- Sequences and series
- Tests for convergence: integral test, comparison tests, ratio and root tests, alternating series test; absolute and conditional convergence
- Power series: Taylor and Maclaurin series, error estimates, applications, differentiation and integration of series
- Differential equations: slope fields, separable differential equations, first order linear differential equations, Euler's method, autonomous differential equations applications
- Polar coordinates – common graphs, derivatives, areas, arc length, and conic sections
- Parametric Equations – derivatives, areas, and arc length

See instructor's syllabus for the detailed outline of weekly readings, activities and assignments.

Evaluation and Assessments

Assessment Type: On-Campus (face-to-face)

Assessment Type	% of Total Grade
Assignments and Quizzes	20%
Midterms – Best 2 of 3	30%
Maple labs	10%
Final Exam	40%
Total	100%

Assessment Type: Online

Assessment Type	% of Total Grade
Lyryx Assignments	10
Quizzes	10
Midterm Exam	30
Maple Labs	10
Final Exam	40

Grade Scheme

A+	A	A-	B+	B	B-	C+	C	C-	D	F
>=90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	<50

Pass requirements: None

Evaluation Notes: A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

Exam Attendance:

Students must attend all scheduled exams at the appointed time and place. Instructors may approve an alternate exam to accommodate an illness or personal crisis. Department heads will consider other written requests. Any student who misses a scheduled exam without prior approval will receive a "0" on the exam.

Academic Policies:

College of the Rockies policies related to courses can be found at https://cotr.bc.ca/about-us/college-policies/ and include the following:

- Policy 2.4.3 Students with Documented Disabilities
- Policy 2.4.4 Student Conduct (plagiarism, other cheating, behavioral misconduct)
- Policy 2.5.8 Academic Performance
- Policy 2.5.3 Grade Appeal
- Policy 2.4.9 Student Concerns Re Faculty

Course Changes:

The College of the Rockies updates course outlines regularly to meet changing educational, employment and marketing needs. The instructor will notify students in writing of any updates to this outline during the semester. The instructor reserves the right to revise, add or delete material while meeting the learning outcomes of this course outline.