MATH-201 – Multivariable Calculus

University Arts and Science

Effective Term & Year: Fall 2022
Course Outline Review Date: 2023-04-01

Program Area: Math and Sciences

Description:

This course takes calculus from the two dimensional world of single variable functions into the three dimensional world, and beyond, of multivariable functions. Topics include vector geometry and the analytic geometry of lines, planes, and surfaces; calculus of curves in two and three dimensions, including arc length and curvature; calculus of scalar valued functions of several variables, including partial and directional derivatives, the gradient, the chain rule, Lagrange multipliers and optimization problems.

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. A student should take both MATH 201 and 202, or MATH 205.

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

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	
Practicum/Field Experience	
Co-op/Work Experience	
Other	
Total	45

Course Requisites:

- Complete all of the following
    - Completed the following:
        - MATH104 – Integral Calculus (3)
    - PHYS 104 is strongly recommended.

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 either British Columbia or Alberta institutions, please see https://www.bctransferguide.ca/ or https://transferalberta.alberta.ca . For more transfer credit information, please visit https://www.cotr.bc.ca/Transfer

All requests for course transfer credit from institutions in British Columba or elsewhere should go to the College of the Rockies Enrolment 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:

Hass, Joel R., Heil, Christopher E., Weir, Maurice D., *Thomas's Calculus: Early Transcendentals,* 14th Edition, Pearson Education (2018)

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:

- perform calculations involving vectors and vector-valued functions in two and three dimensional space including dot and cross products
- sketch, identify, and find intersections of various three dimensional figures including lines, planes, cylinders, and quadric surfaces
- calculate arc length, curvature and torsion; and find the Frenet frame of the curve
- calculate partial derivatives for functions of several variables, calculate gradients and directional derivatives
- solve applied optimization problems both without and with constraints. Use Lagrange multipliers

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.

Course Topics:

- Vectors and Geometry of Space
    - Three-Dimensional Coordinate Systems
    - Vectors
    - Dot and cross products
    - Lines and planes in Space
    - Cylinders and quadric surfaces

- Vector Valued Functions and Motion in Space
    - Curves in Space and Their Tangents
    - Integrals of Vector Functions, Projectile Motion
    - Arc length in Space
    - Curvature and Normal Vectors of a Curve
    - Tangential and Normal Components of Acceleration
    - Velocity and Acceleration in Polar Coordinates

- Partial Derivatives

- Functions of several variables
- Limits and continuity in Higher Dimensions
- Partial derivatives
- The chain rule
- Directional derivatives and Gradient Vectors
- Tangent Planes and Differentials
- Extreme Values and Saddle Points
- Lagrange Multipliers
- Partial Derivatives with Constrained Variables

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	20%
Midterm Tests – Best 2 of 3	30%
Final Exam	50%
Total	100%

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.