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CURRICULUM GUIDE: OFFICIAL COURSE OUTLINE

Course Code	MATH 251	Course Title	Multivariable Calculus			
Credit Value	3	Department	Mathematics and Science			
No. of weeks	14	Hrs. per week	*Lecture*	*Tutorial*	*Laboratory*	*Total*
			4	0	0	4
Course Description	Rectangular, cylindrical and spherical coordinates. Vectors, lines, planes, cylinders, quadric surfaces. Vector functions, curves, motion in space. Differential and integral calculus of several variables. Vector fields, line integrals, fundamental theorem for line integrals, Green's theorem.					
Prerequisite(s)	ENGL 088 (formerly EASL 089/ENGL 097), MATH 105 (B) or MATH 152					

Initial Articulation Targets	*UBC*	*SFU*	*UVic*	*UNBC*	*TRU*
	MATH 220 (3)	MATH 251 (3) – Q	MATH 200 (1.5)	MATH 200 (3)	MATH 2110 (3)
	For updated information on the transferability of this course, please consult the BC Transfer Guide, www.bctransferguide.ca				

Learning Outcomes

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

- Visualize and draw graphs of surfaces and curves in space.
- Demonstrate an understanding of the notion of vectors and be able to perform vector addition, scalar multiplication, dot product, and cross product.
- Perform calculus operations on vector-valued functions including differentiation and integration, finding curvature, and the description of motion in space.
- Perform calculus operations on functions of several variables including partial derivatives (first & second order), directional derivatives, and multiple integrals.
- Solve practical problems, such as constrained optimization problems and other problems by using differentiation and integration of multivariable functions.
- Apply the basics of vector calculus including line integrals, Green's Theorem and surface integrals, to simplify integration problems.

Content

Core topics – all of the following will be covered:

- Polar Coordinates
  - 10.3 Polar coordinates
  - 10.4 Areas and lengths in polar coordinates
  - 10.5 Conic sections
  - 10.6 Conic sections in polar coordinates
- Vectors and Geometry of Space
  - 12.1 Three-dimensional coordinate systems

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	○ 12.2 Vectors ○ 12.3 The dot product ○ 12.4 The cross product ○ 12.5 Equations of lines and planes ○ 12.6 Cylinders and quadric surfaces • Vector Functions ○ 13.1 Vector functions and space curves ○ 13.2 Derivatives and integrals of vector functions ○ 13.3 Arc length and curvature ○ 13.4 Motion in space: velocity and acceleration • Partial Derivatives ○ 14.1 Functions of several variables ○ 14.2 Limits and continuity ○ 14.3 Partial derivatives ○ 14.4 Tangent planes and linear approximations ○ 14.5 The chain rule ○ 14.6 Directional derivatives and the gradient vector ○ 14.7 Maximum and minimum wages ○ 14.8 Lagrange multipliers • Multiple Integrals ○ 15.1 Double integrals over rectangles ○ 15.2 Iterated integrals ○ 15.3 Double integrals over general regions ○ 15.4 Double integrals in polar coordinates ○ 15.5 Applications of double integrals ○ 15.6 Surface area ○ 15.7 Triple integrals ○ 15.8 Triple integrals in cylindrical coordinates ○ 15.9 Triple integrals in spherical coordinates • Vector Calculus ○ 16.1 Vector fields ○ 16.2 Line integrals ○ 16.3 Fundamental theorem for line integrals ○ 16.4 Green's theorem Additional topics may also be covered, at the discretion of the instructor.
Methods of Instruction	Lectures, seminar, problem-based learning, class discussion, group work and assignments

Required Textbook(s)	The following textbook(s) is/are required, or approved equivalent(s). Briggs, William L. et al. Calculus: Early Transcendentals. 3rd Ed. New York: Pearson, 2019. Stewart, James. Calculus - Early Transcendentals. 9th Ed. Cengage Learning, 2021. Or Stewart, James. Multivariable Calculus. 9th Ed. Cengage Learning, 2021.		
Required Equipment and Technology	Students are required to have a computer with internet access. The following resources are provided by the College: • Office 365 • Student email		
Homework Hours	At minimum, students can expect one hour of homework for every hour of instructional time.		
Evaluation	*Component* Assignments, in-class activities, participation Quizzes (weekly, biweekly, module, chapter) Midterm examination(s) Final examination	*% Value* 10-30% 10-30% 20-30% 30-35%	
Completion Requirements	The minimum grade to pass this course is D (50%). Unless otherwise stated, a minimum grade of C- (55%) is required for this course to fulfil a prerequisite.		
Course Designer(s)	Keira Gunn, M.Sc., (Coordinator) Mathematics Department, Alexander College	Consultant(s), *if applicable*	Len Berggren, Ph.D., Department of Mathematics, Simon Fraser University
Dean's Approval	Barbara Moon, Ph.D., Dean of Arts and Sciences, Alexander College	Dean's Approval Date	September 30, 2015
Curriculum Committee Approval Date	September 30, 2015	First Term Offered	Fall 2016
Last Review Date	March 1, 2023	Next Review Date	March 1, 2028
Revision History	May 1, 2014-All MATH and STAT courses will be 4 hours, commencing Fall 2014, per SASC. January 5, 2015-Revision by Len Berggren, Mathematics faculty March 1, 2023-Minor updates (e.g., assessment ranges, textbooks) by Kelly Cheung and Krishna Subedi		