GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: MATH 1C DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Spring 2021 CURRICULUM APPROVAL DATE: 12/8/2020

SHORT TITLE: MULTIVARI CALCULUS

LONG TITLE: Multivariable Calculus

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	4	72
		Lab:	0	0
		Other:	0	0
		Total:	4	72

COURSE DESCRIPTION:

A standard third semester Calculus course covering functions of several variables, vectors, surfaces, vector-valued functions, partial derivatives, multiple and line integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem. PREREQUISITE: Mathematics 1B with a grade of 'C' or better.

PREREQUISITES:

Completion of MATH 1B, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed

STUDENT LEARNING OUTCOMES:

1. Identify, describe, and illustrate level curves, lines, planes, solids, cylinders, and quadric surfaces using three-dimensional coordinate systems.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2016

Semester: Fall

2. Formulate, analyze, and solve problems containing vectors and use parametric equations and vector functions to describe space curves.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

3. Apply differentiation and integration of vector functions to real world problems including arc length, curvature, velocity, and acceleration.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2016

Semester: Fall

4. Apply the concepts of domain, range, evaluation, limits, and continuity to functions of more than one variable.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

5. Formulate, analyze, and solve problems using partial derivatives including directional derivatives, gradient, and optimizations.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

6. Calculate double and triple integrals utilizing various three-dimensional coordinate systems and Jacobian transformations.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2016

Semester: Fall

7. Apply integration of mutilvariable functions to real-world problems including mass, moments, center of mass, surface area, and volume.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2016

Semester: Fall

8. Identify and sketch vector fields; find and sketch gradient fields.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

9. Calculate line integrals and apply the Fundamental Theorem of Line Integrals and Green's Theorem.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

10.Identify parametric surfaces; calculate surface integrals, and apply Stokes' Theorem and the Divergence Theorem.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2012

11. Classify critical points as local extrema or saddle points. Solve extreme value problems with constraints using Lagrange multipliers.

Measure of assessment: Homework, Quiz, Project, Exam

Year assessed, or planned year of assessment: 2018

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 12/8/2020

DE MODIFICATION ONLY

WEEK 1: 4 HOURS

CONTENT

Course introduction. Three-dimensional coordinate systems; distance formula; Vectors.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Represent points, lines, planes and regions in three dimensional coordinates; Perform basic vector

operations.

WEEK 2: 4 HOURS

CONTENT

Dot product; direction angles and direction cosines; projections. Cross product.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Perform dot product, cross product, and triple product calculations; Apply the concepts to direction angles and cosines, work,

projections, torque, areas and volumes.

WEEK 3: 4 HOURS

CONTENT

Vector and parametric equations of lines and planes. Cylinders and quadric surfaces.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project that applies vectors to a three-dimensional coordinate system.

PERFORMANCE OBJECTIVES

The students will be able to: Represent lines and planes using vector, parametric, symmetric, and linear forms; Identify and sketch cylinders and quadric surfaces.

WEEK 4: 4 HOURS

CONTENT

Cylindrical and spherical coordinates. Vector functions and space curves.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Convert between rectangular, cylindrical, and spherical coordinates; Identify surfaces and solids using cylindrical and spherical coordinates; Find domains and limits of vector functions; Sketch space curves by hand and illustrate them with computer software.

WEEK 5: 4 HOURS

CONTENT

Derivatives and integrals of vector functions. Arc length and curvature; normal and binormal vectors.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Find derivatives of vector functions; Evaluate integrals of vector functions; Find arc length, curvature; find unit tangent, normal,

and binormal vectors.

WEEK 6: 4 HOURS

CONTENT

Velocity and acceleration; Kepler's Laws of planetary motion. Functions of two or more variables.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project that explores Kepler's Laws.

PERFORMANCE OBJECTIVES

The students will be able to: Calculate velocity, acceleration, speed, and position of a particle; Find the tangential and normal components of acceleration vectors; Derive and apply Kepler's Laws. Find the domain, range, and values of functions of two or more variables; Describe and sketch functions of two or more variables.

WEEK 7: 4 HOURS

CONTENT

Level Curves. Properties of limits and continuity; Differentiability and differentiation including partial derivatives

and higher derivatives; Partial differential equations.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Analyze limits and continuity of a multivariable function at a point;

Determine differentiability of multivariable functions, and compute partial derivatives and higher derivatives;

Verify solutions to partial differential equations.

WEEK 8: 4 HOURS

CONTENT

Tangent planes; linear approximations; differentials. The Chain Rule; implicit differentiation.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Find the equation of the tangent plane to a surface at a point; Find linear approximations and differentials of a function; Apply the Chain Rule to find partial derivatives; Differentiate functions of two or more variables using implicit differentiation.

WEEK 9: 4 HOURS

CONTENT

Directional derivatives and the gradient vector; maximizing the directional derivative; tangent planes to level surfaces. Maximum and minimum values.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project that determines a maximum or minimum value.

PERFORMANCE OBJECTIVES

The students will be able to: Find directional derivatives and gradient vectors; Find the equations of tangent planes and

normal lines to surfaces; Find local maximum and minimum values using the Second Derivatives Test; Find absolute maximum and minimum values.

WEEK 10: 4 HOURS

CONTENT

Lagrange multipliers. Volumes and double integrals; the midpoint rule; average value.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Classify critical points as local extrema or saddle points. Solve extreme value problems with constraints using Lagrange multipliers; Evaluate double integrals over rectangles.

WEEK 11: 4 HOURS

CONTENT

Iterated integrals. Double integrals over general regions; properties of double integrals. Double integrals in polar coordinates.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Calculate iterated integrals; Sketch solids related to iterated integrals; Set up and evaluate double integrals over general regions; Set up and evaluate double integrals using polar coordinates.

WEEK 12: 4 HOURS

CONTENT

Applications of double integrals. Surface area. Triple integrals.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project that involves mass, center of mass, moments of inertia, etc.

PERFORMANCE OBJECTIVES

The students will be able to: Apply double integrals to mass, center of mass, moments of inertia, etc.; Calculate surface area; Evaluate triple integrals.

WEEK 13: 4 HOURS

CONTENT

Triple integrals in cylindrical and spherical coordinates. Change of variables in multiple integrals.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project that investigates
the intersection of solids.

PERFORMANCE OBJECTIVES

The students will be able to: Set up and evaluate triple integrals using cylindrical and spherical coordinates; Find the Jacobian of a transformation; Use a given transformation to evaluate an integral; Evaluate an integral
by making an appropriate change of variables.

WEEK 14: 4 HOURS

CONTENT

Vector fields. Line integrals including parametrically defined surfaces.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Recognize and sketch vector fields; Interpret, set up, and evaluate line integrals in the plane, in space, and in vector fields.

WEEK 15: 4 HOURS

CONTENT

Fundamental Theorem for Line Integrals; independence of path; conservation of energy. Green's Theorem.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Determine whether a given vector field is conservative; Find a potential function for a conservative vector field; Show independence of path and evaluate line integrals; Evaluate line integrals
using Green's Theorem.

WEEK 16: 4 HOURS

CONTENT

Curl and divergence. Surface integrals including parametrically defined surfaces. Integrals of real-valued functions over surfaces.

HOMEWORK

Read sections covered in textbook and complete homework assignments.

PERFORMANCE OBJECTIVES

The students will be able to: Find the curl and divergence of a vector field; Identify and represent parametric surfaces; Interpret, set up, and evaluate surface integrals.

WEEK 17: 4 HOURS

CONTENT

Stokes' Theorem. The Divergence Theorem. Final Review.

HOMEWORK

Read sections covered in textbook and complete homework assignments. Complete a project investigating the work of mathematicians Green, Stokes, and Thompson.

PERFORMANCE

OBJECTIVES

The students will be able to: Use Stokes' Theorem to evaluate integrals; Use the Divergence Theorem to calculate flux; Discuss the development of mathematical ideas through conjecture and proof.

WEEK 18: 2 HOURS

METHODS OF INSTRUCTION:

Instruction will follow a standard lecture/discussion format. Extensive homework will be assigned in order to assure mastery of the concepts and techniques of multivariable calculus. Students will also be required required to utilize technology, both calculators and computer software, to enhance their understanding of the material.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours: 12

Assignment Description:

1. Regularly assigned homework that requires students to analyze and study pertinent text material, solved examples and lecture notes.

2. Regularly assigned homework that requires students to apply the principles and skills covered in class by solving related problems.

METHODS OF EVALUATION:

Writing assignments

Percent of total grade: 10.00 %

Out-of-class projects.

Problem-solving assignments

Percent of total grade: 10.00 %

Homework, quizzes.

Objective examinations

Percent of total grade: 80.00 %

REPRESENTATIVE TEXTBOOKS:

Required Representative Textbooks

James Stewart. Calculus: Early Transcendentals. Brooks/Cole,2015.

ISBN: ISBN -10: 1285741552

Reading Level of Text, Grade: 12 Verified by: Jennifer Nari

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

GAV B4, effective 200370

CSU GE:

CSU B4, effective 200370

IGETC:

IGETC 2A, effective 200370

CSU TRANSFER:

Transferable CSU, effective 200370

UC TRANSFER:

Transferable UC, effective 200370

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: MATH22
CAN Sequence: MATH SEQ BC
CSU Crosswalk Course Department: MATH
CSU Crosswalk Course Number: 1C
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000279453
Sports/Physical Education Course: N
Taxonomy of Program: 170100