MATH R122: CALCULUS WITH ANALYTIC GEOMETRY III

Originator
jkuang

Co-Contributor(s)

Name(s)
Hall , Steven (shall)

College
Oxnard College

Discipline (CB01A)
MATH - Mathematics

Course Number (CB01B)
R122

Course Title (CB02)
Calculus with Analytic Geometry III

Banner/Short Title
Calculus III

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
As the third semester course in the calculus sequence, this course introduces the calculus of several variables and solid analytic geometry. It includes vector valued functions, calculus of functions of more than one variable, partial derivatives, multiple integration, Green's Theorem, Stoke's Theorem, and the divergence theorem. C-ID: MATH 230

Taxonomy of Programs (TOP) Code (CB03)
1701.00 - Mathematics, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
B - Satisfies Math/Quantitative Reasoning req (CSUGE-B B4, IGETC 2, or 4-yr)

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
87.5
Maximum Contact/In-Class Lecture Hours
87.5

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
175
Maximum Outside-of-Class Hours
175

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
262.5
Total Maximum Student Learning Hours
262.5

Minimum Units (CB07)
5
Maximum Units (CB06)
5

Prerequisites
MATH R121

Entrance Skills

Entrance Skills
Algebra, trigonometry and calculus

Requisite Justification

Requisite Type
Prerequisite

Requisite
Math R121

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students will explain the nature of a vector field and describe conservative vs. non-conservative vector fields.
2	Students will compute and analyze vector quantities and rates.
3	Students will perform operations involving double and triple integrals.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Perform vector operations
2	Determine equations of lines and planes
3	Find the limit of a function at a point
4	Evaluate partial derivatives
5	Write the equation of a tangent plane at a point
6	Determine differentiability
7	Find local extrema and test for saddle points
8	Solve constraint problems using Lagrange multipliers
9	Compute arc length
10	Find the divergence and curl of a vector field
11	Evaluate two and three dimensional integrals
12	Apply Green's, Stokes', and divergence theorems

Course Content

Lecture/Course Content

1. Vectors and vector operations in two and three dimensions
2. Vector and parametric equations of lines and planes; rectangular equation of a plane
3. Dot, cross, and triple products and projections
4. Differentiability and differentiation including partial derivatives, chain rule, higher-order derivatives, directional derivatives, and the gradient
5. Arc length and curvature; tangent, normal, binormal vectors
6. Vector-valued functions and their derivatives and integrals; finding velocity and acceleration
7. Real-valued functions of several variables, level curves and surfaces
8. Limits, continuity, and properties of limits and continuity
9. Local and global maxima and minima extrema, saddle points, and Lagrange multipliers
10. Vector fields including the gradient vector field and conservative fields
11. Double and triple integrals
12. Applications of multiple integration such as area, volume, center of mass, or moments of inertia
13. Change of variables theorem
14. Integrals in polar, cylindrical, and spherical coordinates
15. Line and surface integrals including parametrically defined surfaces
16. Integrals of real-valued functions over surfaces
17. Divergence and curl
18. Green's, Stokes', and divergence theorems

Laboratory or Activity Content

none

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Problem-Solving Assignments
Problem-solving exams
Quizzes
Simulations

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Computer-aided presentations
Class activities
Class discussions
Distance Education
Demonstrations
Group discussions
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

Instructor will lead synchronous and asynchronous interactive instructional activities inside the classroom or via an online meeting platform (e.g. Zoom). In the online environment, group discussions or group activities may be done using Zoom breakout room or via Canvas discussion board. Technologies and simulations will be use as visual aids to enhance understanding.

Representative Course Assignments

Writing Assignments

The course is primarily computational, but students must present written, worked out homework solutions using correct mathematical notation on problems such as those on limits. For example: "Compute the divergence of the given vector field."

Critical Thinking Assignments

Logical, step-by-step solutions of vector calculation, differentiation and integrations, explaining why the method selected is appropriate, and including restrictions for the obtained solution. Interpretation of the solutions of application problems (e.g., optimization problems).

Reading Assignments

Critical reading and thinking in application homework problems, for example: "A rectangular metal sheet has the given density function. Find the mass of the metal sheet."

Skills Demonstrations

Logical, step-by-step solutions of vector calculation, differentiation and integrations, explaining why the method selected is appropriate, and including restrictions for the obtained solution. Interpretation of the solutions of application problems (e.g., optimization problems).

Other assignments (if applicable)

Understand mathematical computational procedures, for example: "Calculate the area of the region bounded by the given curves."

Outside Assignments

Representative Outside Assignments

1. Sections of the textbook and other assigned material before and after each lecture to improve the learning experience of the topics covered in class. Analysis of verbal problems which apply the concepts taught.
2. Logical, step-by-step solutions of vector calculation, differentiation and integrations, explaining why the method selected is appropriate, and including restrictions for the obtained solution. Interpretation of the solutions of application problems (e.g., optimization problems).
3. Regular participation in out-of-class discussions and group work.

Articulation

C-ID Descriptor Number
MATH 230

Status
Approved

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
CSUCI	MATH 250	Calculus III	
CSULA	MATH 2130	Calculus III	
CSU Long Beach	MATH 224	Calculus III	

Comparable Courses within the VCCCD
MATH M25C - Calculus with Analytic Geometry III
MATH V21C - Multivariable Calculus

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
College of the Canyons	MATH 213	Calculus III	
Santa Barbara City College	MATH 200	Multivariable Calculus	

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

D2. Communication/Analytical Thinking
Approved

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 1995

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B4 Mathematical/Quantitative Reasoning
Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 2A: Mathematical Concepts & Quantitative Reasoning
Approved

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Strang, G. and Herman, E. (2020), Calculus Volume 3 by OpenStax, Rice University, Houston, TX 77005.

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Video Conferencing	Live zoom meeting with a combination of lecture, in-class quiz, and group discussion
Other DE (e.g., recorded lectures)	Lecture and assignment solution videos
E-mail	Q&A
Face to Face (by student request; cannot be required)	Optional live Q&A sections
Asynchronous Dialog (e.g., discussion board)	Regular and effective interactions among students and between students and instructor for the online portion of the class will be demonstrated and recorded via Canvas discussion board. Some examples are 1) Whack-a-mole. Each week, three students will be randomly selected to produce solution videos for three different homework questions and post them on the discussion board. One student will be secretly instructed to include a mathematical mistake and other students need to identify who is the mole and what is the mistake. All three students will be encouraged to meet with the instructor in private prior to producing their video presentation. 2) Crowd-source chapter summaries. After each chapter, a few students will be tasked to write a short summary for the chapter and post it on the discussion board. All students will participate and vote in or out certain items from the summary. A different group will be tasked to compile the feedback and write a final draft of the summary. Instructor will monitor the discussion and make public and private comments. 3) Open-ended discussion. Instructor will post open-ended questions like “is it better to add milk to freshly brewed coffee at the beginning or after 20-minutes” (Newton’s Cooling Law). Students will use what they learn in the class to answer and defend their answers. The best answer will be voted by peers using the “like” function in Canvas. 4) Crowd-source exam. Students will crowd-source their own exam questions and the best answer will be voted by peers using the “like” function in Canvas.

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100% online Modality:

Method of Instruction	**Document typical activities or assignments for each method of instruction**
Other DE (e.g., recorded lectures)	Lecture and assignment solution videos
E-mail	Q&A
Face to Face (by student request; cannot be required)	Optional live Q&A sections
Asynchronous Dialog (e.g., discussion board)	Regular and effective interactions among students and between students and instructor for the online portion of the class will be demonstrated and recorded via Canvas discussion board. Some examples are 1) Whack-a-mole. Each week, three students will be randomly selected to produce solution videos for three different homework questions and post them on the discussion board. One student will be secretly instructed to include a mathematical mistake and other students need to identify who is the mole and what is the mistake. All three students will be encouraged to meet with the instructor in private prior to producing their video presentation. 2) Crowd-source chapter summaries. After each chapter, a few students will be tasked to write a short summary for the chapter and post it on the discussion board. All students will participate and vote in or out certain items from the summary. A different group will be tasked to compile the feedback and write a final draft of the summary. Instructor will monitor the discussion and make public and private comments. 3) Open-ended discussion. Instructor will post open-ended questions like "is it better to add milk to freshly brewed coffee at the beginning or after 20-minutes" (Newton's Cooling Law). Students will use what they learn in the class to answer and defend their answers. The best answer will be voted by peers using the "like" function in Canvas. 4) Crowd-source exam. Students will crowd-source their own exam questions and the best answer will be voted by peers using the "like" function in Canvas.

Examinations

Hybrid (1%–50% online) Modality

Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
MATHEMATICS

Review and Approval Dates

Department Chair
08/28/2020

Dean
08/28/2020

Technical Review
09/09/2020

Curriculum Committee
09/09/2020

Curriculum Committee
10/28/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000244077

DOE/accreditation approval date
MM/DD/YYYY