COLLEGE OF THE DESERT

Course Code MATH-002A

Course Outline of Record

1. Course Code: MATH-002A
2. a. Long Course Title: Multivariate Calculus
   b. Short Course Title: MULTIVARIATE CALCULUS
3. a. Catalog Course Description:
   This course extends the concepts of differentiation and integration introduced in the first two semesters of calculus to functions of several variables. Topics include solid Euclidean geometry, vector algebra in 3 dimensions, line and surface integrals, multiple integration in rectangular, cylindrical and spherical coordinates, extreme values, parameterized space curves and surfaces, divergence, directional derivatives, gradients, Gauss', Green's and Stokes' theorems.
   b. Class Schedule Course Description:
   This is the third semester of the Calculus sequence. It covers differential and integral Calculus of several variables.
   c. Semester Cycle (*if applicable*): This course is offered every fall semester.
   d. Name of Approved Program(s):
   - MATHEMATICS Associate in Science for Transfer Degree (AS-T)
4. Total Units: 4.00 Total Semester Hrs: 108.00
   Lecture Units: 3 Semester Lecture Hrs: 54.00
   Lab Units: 1 Semester Lab Hrs: 54.00
   Class Size Maximum: 35 Allow Audit: No
   Repeatability No Repeats Allowed
   Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: MATH 001B
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Stewart, James (2016). *Multivariable Calculus* (8th/e). Brooks Cole. ISBN: 9781305266643
   College Level: Yes
   Flesch-Kincaid reading level: 13.1
7. Entrance Skills: *Before entering the course students must be able:*

   a.
   Evaluate definite and indefinite integrals using a variety of integration formulas and techniques.

   - MATH 001B - Evaluate definite and indefinite integrals using a variety of integration formulas and techniques;

   b.
   Apply integration to areas and volumes, and other applications such as work or length of a curve.

   - MATH 001B - Apply integration to areas and volumes, and other applications such as work or length of a curve;

   c.
   Evaluate improper integrals.

   - MATH 001B - Evaluate improper integrals;

   d.
   Apply convergence tests to sequences and series.

   - MATH 001B - Apply convergence tests to sequences and series;

e.
Represent functions as power series.

- MATH 001B - Represent functions as power series; and

f.
Graph, differentiate and integrate functions in polar and parametric form.

- MATH 001B - Graph, differentiate and integrate functions in polar and parametric form.

8. Course Content and Scope:

Lecture:

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 with rectangular, cylindrical and spherical coordinates;
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; and
18. Green's, Stokes', and divergence theorems.

Lab: *(if the "Lab Hours" is greater than zero this is required)*

1. Use of technology such as Maple or Mathematica to graph and analyze 3-dimensional objects.
2. Applications of topics discussed in lecture using appropriate mathematical tools.

9. Course Student Learning Outcomes:

1.
Use multivariable calculus to show critical and logical thinking by evaluating and applying limits, derivatives, and integrals to functions of several variables.

2.
Define vectors, perform vector operations, and represent vector-valued functions as curves and surfaces in two or three dimensions.

3.
Define and compute partial and directional derivatives of functions and solve application problems (including optimization problems) that involve rates of change in two or three dimensions.

4.
Apply the concept of integral to line and surface integrals in physics applications.

10. Course Objectives: *Upon completion of this course, students will be able to:*

a. Perform vector operations;
b. Determine equations of lines and planes;
c. Find the limit of a function at a point;
d. Evaluate derivatives;
e. Write the equation of a tangent plane at a point;
f. Determine differentiability;
g. Find local extrema and test for saddle points;
h. Solve constraint problems using Lagrange multipliers;
i. Compute arc length;
j. Find the divergence and curl of a vector field;
k. Evaluate two and three dimensional integrals; and
l. Apply Green's, Stokes', and divergence theorems.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Discussion
    b. Laboratory
    c. Lecture
    d. Technology-based instruction

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
    In Class Hours: 108.00
    Outside Class Hours: 108.00
    a. In-class Assignments
        1. Attend classroom lectures and take notes.
        2. Participate in classroom discussions to review, analyze, diagnose, and evaluate various methods of solution used in homework assignments.
        3. Complete laboratory assignments using appropriate mathematical tools.
        4. Complete examinations involving problems that apply studied principles to new situations.
    b. Out-of-class Assignments
        1. Read textbooks and supplementary assignments.
        2. Complete assigned homework including problem solving, exercises to improve skills and mathematical understanding.
        3. Complete examinations involving problems that apply studied principles to new situations.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - College level or pre-collegiate essays
    - Written homework
    - Guided/unguided journals
    - Portfolios
    - Term or research papers
    - Reading reports
    - Laboratory projects
    - Computational/problem solving evaluations
    - Presentations/student demonstration observations
    - Group activity participation/observation
    - Product/project development evaluation
    - Self/peer assessment and portfolio evaluation
    - True/false/multiple choice examinations
    - Mid-term and final evaluations
    - Student participation/contribution
    - Student preparation

- Oral and practical examination
- Other

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*
PO-GE C4.b - Language & Rationality (Communication & Analytical Thinking)
Gather, assess, and interpret relevant information.
Apply logical and critical thinking to solve problems; explain conclusions; and evaluate, support, or critique the thinking of others.
IO - Scientific Inquiry
Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.
IO - Global Citizenship - Scientific & Technological Literacy
Utilize quantitative expression in a variety of contexts. These would include units of measurement, visual representations, and scales and distributions.
Synthesize, interpret, and infer, utilizing information, data, and experience to solve problems, innovate, and explore solutions.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year

17. Special Materials and/or Equipment Required of Students:
Graphing and programmable calculator

18. Materials Fees: ☐ Required Material?

Material or Item	Cost Per Unit	Total Cost

19. Provide Reasons for the Substantial Modifications or New Course:

update textbook to a newer edition and update SLO.

20. a. Cross-Listed Course *(Enter Course Code)*: *N/A*
b. Replacement Course *(Enter original Course Code)*: *N/A*

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements
a. Course Control Number [CB00]: CCC000568549
b. T.O.P. Code [CB03]: 170100.00 - Mathematics, General
c. Credit Status [CB04]: C - Credit - Not Degree Applicable
d. Course Transfer Status [CB05]: A = Transfer to UC, CSU
e. Basic Skills Status [CB08]: 2N = Not basic skills course
f. Vocational Status [CB09]: Not Occupational
g. Course Classification [CB11]: Y - Credit Course
h. Special Class Status [CB13]: N - Not Special
i. Course CAN Code [CB14]: *N/A*
j. Course Prior to College Level [CB21]: Y = Not Applicable
k. Course Noncredit Category [CB22]: Y - Not Applicable
l. Funding Agency Category [CB23]: Y = Not Applicable
m. Program Status [CB24]: 1 = Program Applicable
Name of Approved Program *(if program-applicable)*: MATHEMATICS

Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 0
    Third Year: 0

24. Resources - Faculty - Discipline and Other Qualifications:
    a. Sufficient Faculty Resources: Yes
    b. If No, list number of FTE needed to offer this course: *N/A*
25. Additional Equipment and/or Supplies Needed and Source of Funding.
    N/A
26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
    N/A
27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
    Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes
28. Originator Thang Le Origination Date 10/20/17