RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC COURSE OUTLINE

MATH 251 CALCULUS III

I. Basic Course Information

A. Course Number and Title: MATH 251 Calculus III

B. New or Modified Course: Modified Course

C. Date of Proposal: Spring 2020

D. **Effective Term: Fall 2020**

E. Sponsoring Department: Mathematics and Computer Science

F. Semester Credit Hours: 4

G. Weekly Contact Hours: 5 Lecture: 3
Laboratory: 2
Out of class student work per week: 7

H. Prerequisites: MATH 152 Calculus II or MATH 152H Calculus II Honors with grade of C or better.

I. Laboratory Fees: None

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval:
Department Chair: Dr. Lori Austin, Lori.Austin@raritanval.edu, x8576 Divisional Dean: Dr. Sarah A. Imbriglio, Sarah.Imbriglio@raritanval.edu, x8241

II. Catalog Description

Prerequisite: MATH 152 Calculus II or MATH 152H Calculus II Honors with grade of C or better. Third semester of calculus with a technology-based computer laboratory. Topics include vectors, vector-valued functions, curves in space, functions of two or more variables, partial differentiation, multiple integrals, line integrals, Green's Theorem, Divergence Theorem, and Stokes' Theorem. The Honors Option is available for this course.

III. Statement of Course Need

~~A. Enrollment History: In the fall 2014 semester we have approximately 38 students who registered for Calculus III.~~

B. The two-hour lab is standard for all of our Calculus I, II, and III sections. It enables the students to use technology to help them become proficient in the course material.

C. This course also serves as a math requirement for programs in Engineering Science and Mathematics.

D. This course serves as a Mathematics Elective for Computer Science.

IV. Place of Course in College Curriculum

A. This course is a free elective ~~and a Mathematics elective for all programs.~~
B. This course serves as a General Education requirement in Mathematics.
C. This course meets a program requirement in ~~Biology,~~ Computer Science, Engineering Science~~, General Science~~, Physics and Mathematics.
D. This course transfers as a third semester calculus course. Course transferability; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go their individual

V. Outline of Course Content

A. Vectors and the Geometry of Space
    1. Vectors in the Plane
    2. Vectors in Three Dimensions
    3. Dot Products
    4. Cross Products
    5. Lines and Planes in Space
    6. Cylinders and Quadric Surfaces

B. Vector-Valued Functions
    1. Vector-Valued Functions
    2. Calculus of Vector-Valued Functions
    3. Motion in Space
    4. Length of Curves
    5. Curvature and Normal Vectors

C. Functions of Several Variables
    1. Graphs and Level Curves
    2. Limits and Continuity
    3. Partial Derivatives
    4. The Chain Rule
    5. Directional Derivatives and the Gradient

6. Tangent Planes and Linear Approximation
7. Maximum/Minimum Problems
8. Lagrange Multipliers

D. Multiple Integration
1. Double Integrals over Rectangular Regions
2. Double Integrals over General Regions
3. Double Integrals in Polar Coordinates
4. Triple Integrals
5. Triple Integrals in Cylindrical and Spherical Coordinates
6. Integrals for Mass Calculations
7. Change of Variables in Multiple Integrals

E. Vector Calculus
1. Vector Fields
2. Line Integrals
3. Conservative Vector Fields
4. Green's Theorem
5. Divergence and Curl
6. Surface Integrals
7. Stokes' Theorem
8. Divergence Theorem

VI. General Education and Course Learning Outcomes

A. **General Education Learning Outcomes:**

At the completion of the course, students will be able to:

1. Compute with vectors in three-dimensional space (GE-NJ 2)
2. Differentiate functions of several variables, including graphing functions of two variables. (GE-NJ 2)
3. Evaluate multiple integrals (GE-NJ 2)
4. Utilize Green's Theorem to evaluate line integrals (GE-NJ 2)

B. **Course Learning Outcomes:**

See above

C. **Assessment Instruments**

A. tests
B. final examination
C. projects
D. laboratory products
E. quizzes

VII. Grade Determinants

Factors that may enter into the determination of the final grade:

A. cumulative final examination
B. tests
C. projects
D. individual teacher determinants

Primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture
B. small groups
C. labs with technology component
D. homework
E. quizzes
F. projects
G. tests
H. cumulative Final Examination

VIII. Texts and Materials

A. Suggested Textbook: *Calculus Early Transcendentals*, latest edition, by Briggs, Cochran, Gillett, and Schulz, Pearson Addison Wesley, or similar textbook.

   Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

B. A graphing calculator may be required; TI-84 is recommended

IX. Resources

This course is held in a computer lab for two hours a week. The computers need to be installed with the calculus software currently licensed to the math department. Contact the math department chair to determine which software to install.

X. Honors Options

Definition: According to the Honors Council, an Honors course is one that enriches and challenges students beyond a course's regular scope and curriculum. An Honors course will offer a sophisticated use of research, introduce intellectually stimulating readings and critical perspectives, promote a higher level of critical discussion and written work, and encourage independent study projects, at the option of the instructor.

A. **Prerequisite**: GPA of 3.5 or permission of the instructor

B. **General Education and Course Learning Outcomes**

In addition to the education goals and learning outcomes in Roman numeral VI. A and B listed above, students should be able to:

1. Demonstrate how formulas are derived
2. Provide proofs of theorems appropriate to the Calculus III level
3. Solve challenging and advanced application problems

C. **Honors Option Content**

Students who participate in the Calculus III Honors Option must complete three additional assignments. For the third assignment the student is given a choice to select one of three mathematical activities described in item 3 below.

1. Students must present two proofs assigned by the instructor that are relevant to the main theorems of the course or are an enrichment of them. The instructor will assign a time for the presentation and students in the class will be invited and encouraged to attend.

2. Students must complete two extra Lab assignments. These Honors Lab Assignments will be on the theory portion of the course or on application problems.

3. Students must choose and complete one of the following three mathematical activities:

    a. Investigate and solve two assigned advanced problems.

    b. Write a project that requires investigating a problem, state the theoretical foundation of the problem and its solution and apply techniques of multiple integration to solve the problem

    c. Submit a poster on a topic or an application problem in Calculus III and present it at the Mathematical Association of America Spring or Fall Student Poster Session.

D. **Assessment Instruments for Honors Option Work**

Honors Option students will be assessed for their ability to deliver the additional required assignments. In particular they must:

1. Make a clear and in-depth presentation of two proofs
2. Hand in two additional lab assignments;
3. Complete one of the following: design a poster, complete a written project that requires investigating and solving a problem or solve two advanced application problems

E. **Grade Determinants for Honors Option Work**

In addition to quizzes, labs, tests and final exam, the final grade for students in the Honors Option will be based upon students completing the three additional assignments described above.

F. **Extra Resource Materials for the Honors Option**

In addition to the suggested textbook above, students may need to use:

a. Computer lab with Mathematica software

Selected articles appropriate to the Calculus III level from the *College Mathematics Journal*, a publication of the Mathematical Association of America