**1. COURSE TITLE\*:** Calculus III

**2. CATALOG – PREFIX/COURSE NUMBER/COURSE SECTION\*: MATH 2223**

**3. PREREQUISITE:**

* Math 2222 or Math 222, or the equivalent.

**COREQUISITE(S)\*: None**

**4. COURSE TIME/LOCATION/MODALITY: (*Course Syllabus – Individual Instructor Specific*)**

**5. CREDIT HOURS\*:** 4 **LECTURE HOURS\*:** 4

**LABORATORY HOURS\*:** 0 **OBSERVATION HOURS\*:** 0

**6. FACULTY CONTACT INFORMATION: *(Course Syllabus – Individual Instructor Specific)***

**7. COURSE DESCRIPTION\*:**

This course concerns multivariable calculus and is a continuation of Math 2222 Calculus II. It includes applications of vectors and vector functions; partial derivatives and their applications, including gradients; multiple integration in rectangular, polar, cylindrical and spherical coordinates; vector fields, line integrals, curl and divergence, and Green’s, Stokes’ and Divergence Theorems.

**8. LEARNING OUTCOMES\*:**

 At the completion of this course the student will be able to:

 1. Perform and apply vector operations, including the dot and cross product of vectors, in the plane and space. Graph and find equations of lines, planes, cylinders and quadratic surfaces. [OMT018 – Outcome 1]

 2. Differentiate and integrate vector-valued functions. For a position vector function of time, interpret these as velocity and acceleration. [OMT018 – Outcome 2]

3. Evaluate limits and determine the continuity and differentiability of functions of several variables. [OMT018 – Outcome 3]

4. Describe graphs, level curves and level surfaces of functions of several variables. [OMT018 – Outcome 4]

5. Find arc length and curvature of space curves, including the use of unit tangents and unit normals; identify and interpret tangential and normal components of acceleration. [OMT018 – Outcome 5]

6. Find partial derivatives, directional derivatives, and gradients and use them to solve applied problems. [OMT018 – Outcome 6]

7. Find differentials of functions of several variables and use them to solve applied problems. [OMT018 – Outcome 7]

8. Find equations of tangent planes and normal lines to surfaces that are given implicitly or parametrically. [OMT018 – Outcome 8]

9. Use the chain rule for functions of several variables (including implicit differentiation). [OMT018 – Outcome 9]

10. For functions of several variables, find critical points using first partials and interpret them as relative extrema/saddle points using the second partials test. Find absolute extrema on a closed region. Apply these techniques to optimization problems. [OMT018 – Outcome 10]

11. Use Lagrange multipliers to solve constrained optimization problems. [OMT018 – Outcome 11]

12. Evaluate multiple integrals in appropriate coordinate systems such as rectangular, polar, cylindrical and spherical coordinates and apply them to solve problems involving volume, surface area, density, moments and centroids. [OMT018 – Outcome 12]

13. Use Jacobians to change variables in multiple integrals. [OMT018 – Outcome 13]

14. Evaluate line and surface integrals. Identify when a line integral is independent of path and use the Fundamental Theorem of Line Integrals to solve applied problems. [OMT018 – Outcome 14]

15. Identify conservative and inverse square fields. [OMT018 – Outcome 15]

16. Find the curl and divergence of a vector field, the work done on an object moving in a vector field, and the flux of a field through a surface. Use these ideas to solve applied problems. [OMT018 – Outcome 16]

 17. Introduce and use Green’s Theorem, the Divergence (Gauss’s) Theorem and Stokes’ Theorem. [OMT018 – Outcome 17]

**9.       ADOPTED TEXT(S)\*:**

           *Calculus*. Third Edition.

 Briggs, Cochran, Gillett, Schulz

Pearson, 2019

ISBN # 978-0-13-476563-1

**9a: SUPPLEMENTAL TEXTS APPROVED BY FULL TIME DEPARTMENTAL FACULTY (INSTRUCTOR MUST NOTIFY THE BOOKSTORE BEFORE THE TEXTBOOK ORDERING DEADLINE DATE PRIOR TO ADOPTION) \*\*\*.**

**10. OTHER REQUIRED MATERIALS: (SEE APPENDIX C FOR TECHNOLOGY REQUEST FORM.)\*\***

A scientific calculator is required; a graphing calculator is strongly recommended. Symbolic manipulator calculators (e.g., TI–89 or TI-Nspire) are prohibited on tests.

**11. GRADING SCALE\*\*\*:**

Grading will follow the policy in the catalog. The scale is as follows:

A: 90 – 100

 B: 80 – 89

 C: 70 – 79

 D: 60 – 69

 F: 0 – 59

**12. GRADING PROCEDURES OR ASSESSMENTS: (*Course Syllabus – Individual Instructor Specific)***

|  |
| --- |
| *Example 1 - By Percent* |
|  Homework 10% Quizzes/Tests 90% Total 100% |

|  |
| --- |
| *Example 2*  |
| *Category* | *By Total Points* | *% of Grade* |
| Homework (20x10) | 200 | 10% |
| Quizzes/Tests(5x360) | 1800 | 90% |
| Total | 2000 | 100% |

|  |
| --- |
| *Example 3* |
| *Category* | *By Total Points* | *% of Grade* |
| Online Quizzes | 400 | 100% |
| Online Tests(6x100) | 600 | 15% |
| Notebook(2x500) | 1000 | 25% |
| Midterm | 1000 | 25% |
| Final | 1000 | 25% |
| Total | 4000 | 100% |

**13. COURSE METHODOLOGY: *(Course Syllabus – Individual Instructor Specific)***

The course design provides instruction and materials to support the course objectives.  Classes may consist of a variety of means to accomplish this including but not limiting to: lectures, class discussions, small group projects, supplemental materials, and outside assignments.  Practice is an important part of the learning process.  For every one hour of class time, two additional hours of study time should be expected.

**14. COURSE OUTLINE: *(Course Syllabus – Individual Instructor Specific)***

 TAG Summary: This outline covers all Learning Standards in OMT018 - Standards 1-17

 **Chapter 13 Vectors and the Geometry of Space** **(OMT018 – Outcome 1)**

13.1 Vectors in the Plane

 13.2 Vectors in Three Dimensions

 13.3 Dot Products

 13.4 Cross Products

 13.5 Lines and Planes in Space

 13.6 Cylinders and Quadratic Surfaces

 **Chapter 14 Vector Functions (OMT018 – Outcomes 2, 5)**

14.1 Vector – Valued Functions

 14.2 Calculus of Vector- Valued Functions.

 14.3 Motion in Space

 14.4 Lengths of Curves

 14.5 Curvature and Normal Vectors

 **Chapter 15 Functions of Several Variables (OMT018 – Outcomes, 3, 4, 6-11)**

 15.1 Graphs and Level Curves

 15.2 Limits and Continuity

 15.3 Partial Derivatives

 15.4 The Chain Rule

 15.5 Directional Derivatives and the Gradient

 15.6 Tangent Planes and Linear Approximation

 15.7 Maximum/Minimum Problems

 15.8 Lagrange Multipliers

 **Chapter 16 Multiple Integrals** **(OMT018 – Outcomes 12-13)**

 16.1 Double Integrals over Rectangles.

 16.2 Double Integrals over General Regions

 16.3 Double Integrals in Polar Coordinates.

 16.4 Triple Integrals.

 16.5 Triple Integrals in Cylindrical and Spherical Coordinates

 16.6 Integrals for Mass Calculations

 16.7 Change of Variables in Multiple Integrals.

 **Chapter 17 Vector Calculus (OMT018 – Outcomes 14-17)**

17.1 Vector Fields.

 17.2 Line Integrals.

 17.3 Conservative Vector Fields

 17.4 Green’s Theorem

 17.5 Divergence and Curl

 17.6 Surface Integrals.

 17.7 Stokes’ Theorem.

 17.8 The Divergence Theorem.

**15. SPECIFIC MANAGEMENT REQUIREMENTS\*\*\*:**

 Suggested pace for the course, by section numbers:

Week 1: 13.1, 13.2, 13.3

Week 2: 13.4, 13.5

Week 3: 13.5, 13.6, 14.1

Week 4: 14.2, 14.3, 14.4

Week 5: 14.5, 15.1, 15.2

Week 6: 15.3, 15.4

Week 7: 15.5, 15.6

Week 8: 15.7, 15.8

Week 9: 16.1, 16.2, 16.3

Week 10: 16.4, 16.5

Week 11: 16.6, 16.7

Week 12: 17.1, 17.2

Week 13: 17.3, 17.4

Week 14: 17.5, 17.6

Week 15: 17.7, 17.8

Week 16: **Finals**

**16. FERPA:\***

Students need to understand that your work may be seen by others. Others may see your work when being distributed, during group project work, or if it is chosen for demonstration purposes. Students also need to know that there is a strong possibility that your work may be submitted to other entities for the purpose of plagiarism checks.

**17. DISABILITIES:\***

Students with disabilities may contact the Disability Services Office, Central Campus, at 800-628-7722 or 937-393-3431.

**18. OTHER INFORMATION\*\*\*:**

**SYLLABUS TEMPLATE KEY**

**\*** Item cannot be altered from that which is included in the master syllabus approved by the Curriculum Committee.

**\*\*** Any alteration or addition must be approved by the Curriculum Committee

\*\*\*Item should begin with language as approved in the master syllabus but may be added to at the discretion of the faculty member.