HOSTOS COMMUNITY COLLEGE
DEPARTMENT OF MATHEMATICS

MAT 310	**CALCULUS III**
CREDIT HOURS:	**4.0**
EQUATED HOURS:	**4.5**
CLASS HOURS:	**4.5**
PREREQUISITE:	**MAT 220 (Calculus II) with a grade of C or higher**
REQUIRED TEXTS:	**Thomas, Weir & Hass: Calculus, Multivariable, 13th Edition, Pearson**
DESCRIPTION:	**This course provides skills in geometry in the plane and space, and integral calculus in several variables. Topics: vectors, solid analytic geometry, polar coordinates, partial derivatives, multiple integral with applications, Green's theorem, Stokes' theorem and the Divergence theorem.**
EXAMINATIONS:	**A minimum of four partial tests (suggested: 60%) and a comprehensive final examination (40%).**
GRADES:	**A, A^-, B^+, B, B^-, C^+, C, D, I, F.**

Math 310 (Calculus III) Student Learning Outcomes

1. Interpret and draw appropriate inferences of derivatives and integrals of functions and their properties from quantitative representations such as graphs of polynomial, rational and trigonometric functions of several variables including vector valued functions. Geometric description and analytic representation of lines and planes.
2. Use algebraic, numerical, and graphical methods to solve mathematical problems including finding the limit of a function of several variables, determining partial derivatives, continuity, and differentiability of a function of several variables.
3. Represent quantitative problems expressed in natural language in suitable algebraic, functional, and graphical form.
4. Effectively communicate solutions to mathematical problems in written, graphical or analytic form.
5. Evaluate solutions to problems and graphs of functions for reasonableness by inspection.
6. Apply calculus-based methods to problems in other fields of study such as Physics, Economics, Geometry, Chemistry or Biology.

Pathways Learning Outcomes:

Mathematical and Quantitative Reasoning:

MAT 310 will meet all the following Pathways Learning Outcomes from "Mathematical and Quantitative Reasoning". A student will:

1. Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.

2. Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.

3. Represent quantitative problems expressed in natural language in a suitable mathematical format.

4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.

5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.

6. Apply mathematical methods to problems in other fields of study.

Flexible Common Core:

MAT 310 will meet all the following Pathways Learning Outcomes from "Flexible Common Core". A student will:

1. Gather, interpret, and assess information from a variety of sources and points of view.

2. Evaluate evidence and arguments critically or analytically.

3. Produce well-reasoned written or oral arguments using evidence to support conclusions

4. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.

5. Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.

6. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.

Student Learning Outcomes**	Mathematical and Quantitative Reasoning Outcomes**	Flexible Common Core Outcomes**	Assessments and topics***
SLO 1	MQR 1	FCC 1	Test#1,2,3,4, and Final
SLO 2	MQR 2	FCC 2	Test#1,2,3,4, and Final
SLO 3	MQR 3	FCC 3	Test#1,2,3,4, and Final
SLO 4	MQR 4	FCC 4	Test#1,2,3,4, and Final
SLO 5	MQR 5	FCC 5	Test#1,2,3,4, and Final
SLO 6	MQR 6	FCC 6	Test#1,2,3,4, and Final

** Please see above for the list of SLO, MQR, and FCC Outcomes

*** Please see blow for the list of topics that will be assessed in each unit test and final exam

SLO#1, MQR#1, and FCC#1:

- Unit Test #1: Find derivatives and integrals of vector values function
- Unit Test #2: Find local max, local min, and saddle points of multivariable functions.
- Unit Test #3: Interpret double integral as algebraic sum of sign volumes.
- Unit Test #4: Draw vector field. Interpret line integral as work.
- Departmental Final Exam: Cumulative

SLO#2, MQR#2, and FCC#2:

- Unit Test #1: Find equations of lines and planes from the description. Interpret cross product and dot product geometrically.
- Unit Test #2: Apply chain rule to find derivative at a specific point.
- Unit Test #3: Use Spherical and Cylindrical coordinate to compute triple integral
- Unit Test #4: Use Green's theorem to compute line integral and 2D flux.
- Departmental Final Exam: Cumulative

SLO#3, MQR#3, and FCC#3:

- Unit Test #1: Represent space curved in parametric format and interpret curvature and normal component in the light of motion.
- Unit Test #2: Interpret directional derivative in a problem in term of geometrical picture.
- Unit Test #3: Interpret and represent double integral and triple integral to find area and volumes.
- Unit Test #4: Express the meaning of Stoke's theorem and Divergence theorem in a natural language in specific circumstances.
- Departmental Final Exam: Cumulative

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SLO#4, MQR#4, and FCC#4:

- Unit Test #1: Effectively communicate the geometric pictures of conic sections with the equations.
- Unit Test #2: Graph and find the formula of lines and planes given the description.
- Unit Test #3: Draw the area of integration for a double integral and change the order of integration.
- Unit Test #4: Communicate solutions to line integral and flux problems in accurate and appropriate form which may be written, graphical or analytic.
- Departmental Final Exam: Cumulative

SLO#5, MQR#5, and FCC#5:

- Unit Test #1: Use dot product to check the accuracy of cross product.
- Unit Test #2: Graph gradient vector field and level curves to see they are perpendicular or not and check the error in the process.
- Unit Test #3: Use general substitution to evaluate double integral and also direct calculation and compare the answer.
- Unit Test #4: Use direct calculation using parametrization to calculate line integral and then also calculate using fundamental theorem of calculus and compare the answers.
- Departmental Final Exam: Cumulative

SLO#6, MQR#6, and FCC#6:

- Unit Test #1: Use curvature to learn application of motion in three-dimensional space.
- Unit Test #2: Describe application problems in Business, Social Sciences, Biology and Chemistry involving multivariable functions
- Unit Test #3: Apply double integral to find center of mass and moments – this is an application in Physics.
- Unit Test #4: Use line integral to find works, flow and circulation.
- Departmental Final Exam: Cumulative

SUGGESTED COURSE OUTLINE

WEEK	CLASS	TOPICS
1	**1**	Parametrization of Plane Curves, Calculus with Parametric Curves
	2	Polar Coordinates and Graphing in Polar Coordinates
	3	Areas and Lengths in Polar Coordinates
2	**4**	Conic Sections and Conic Sections in Polar Coordinates
	5	Three-Dimensional Coordinate Systems
	6	Vectors
3	**7**	The Dot Product
	8	The Cross Product
	9	Lines and Planes in Space
4	**10**	Cylinders and Quadric Surfaces
	11	Curves in Space and Their Tangents, Integrals of Vector Functions; Projectile Motion
	12	Arc Length in Space
5	**13**	Curvature*. Normal Vectors of a Curve
	14	Normal Components of Acceleration.
	15	**Review for Exam 1**
6	**16**	**EXAM 1 (Suggested 15%)**
	17	Functions of Several Variables, Limits and Continuity in Higher Dimensions
	18	Partial Derivatives
7	**19**	The Chain Rule
	20	Directional Derivatives and Gradient Vectors. Tangent Planes. Differentials.*
	21	Extreme Values and Saddle Points
8	**22**	Lagrange Multipliers
	23	**Review for Exam 2**
	24	**EXAM 2 (Suggested 15%)**
9	**25**	Double and Iterated Integrals over Rectangles and General Regions
	26	Area by Double Integration
	27	Double Integrals in Polar Form
10	**28**	Triple Integrals in Rectangular Coordinates
	29	Triple Integrals in Cylindrical and Spherical Coordinates
	30	Substitutions in Multiple Integrals. Moments*. Centers of Mass.*
11	**31**	**Review for Exam 3**
	32	**EXAM 3 (Suggested 15%)**
	33	Line Integrals, Vector Fields and Line Integrals; Work*, Circulation* and Flux*
12	**34**	Path Independence, Conservative Fields and Potential Functions
	35	Green's Theorem in the Plane
	36	Surfaces and Area
13	**37**	Surface Integrals
	38	Stokes Theorem
	39	The Divergence Theorem and a Unified Theory
14	**40**	**Review For Exam 4**
	41	**EXAM 4 (Suggested 15%)**
	42	**Review for Final**
15		**Final Exam (Suggested 40%)**

* Denotes optional material.