**College of Science and Health**

**Department of Mathematics**

**MAEN** 5120 **Course Outline**

Multivariable Calculus

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| 1. | Title of Course, Course Number and Credits:Multivariable Calculus – MAEN 5120 4 credits |
| 2. | **Description of Course:** Infinite Series; Study of vectors and the Geometry of Space; vector valued functions, differentiation and integration of vector-valued functions; calculus of functions of several variables including partial differentiation and multiple integrals; higher order derivatives and their applications. |
| 3. | **Course Prerequisites**:   Calculus II – MAEN 5100 |
| 4. | **Course Objectives:**   To study infinite series and to extend the concepts from one variable calculus to functions of several variables and vector valued functions. These objectives include:* Convergence tests
* Power Series
* Taylor Series
* Representations of Functions by Taylor Series
1. representations and operations with functions
2. vector functions
3. directional derivatives
4. gradient
5. tangent planes
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| 5. | Student Learning Outcomes. Through class assignments, in class quizzes and tests, final exam, and projects.Students will be able to:* Effectively write mathematical solutions in a clear and concise manner.
* Locate and use information to solve calculus problems in several variables.
* Demonstrate ability to think critically effectively interpreting and using functions of several variables.
* Demonstrate ability to think critically by recognizing patterns and determining and using appropriate techniques for solving a variety of integration and differentiation problems.
* Demonstrate the ability to think critically by setting up and solving application problems involving double and triple integrals.
* Work effectively with others to complete homework and class assignments.
* Demonstrate the ability to learn a topic through independent study.
* Demonstrate an intuitive and computational understanding for calculus applications by solving a variety of problems from physics, engineering and mathematics.
* Demonstrate the ability to differentiate and integrate vector-valued functions.
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| 6. | Topical Outline of the Course Content: 1.Infinite Sequences 5 weeksInfinite Series and ConvergenceGeometric and telescoping seriesThe Integral and p-SeriesComparison Tests for Infinite SeriesAlternating Series: Conditional and Absolute convergenceTaylor Polynomials and ApproximationsTaylor SeriesRepresentations of Functions by Taylor Series |
|  | 2. | Vectors in the Plane and Space. Distance in space. Dot and Cross Product and Curves in the Plane and Space. | 3 weeks |
|  | 3. | Vector-valued functions and their differentiation and integration; Tangent and Normal vectors; arc length and curvature. | 3 weeks |
|  | 4. | Functions of Several variables; Graphs and Level Surfaces. Limits, Continuity; Partial Derivatives. Differentiability.  | 3 weeks |
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| 7. | Guidelines/Suggestions for Teaching Methods and Student Learning Activities:This course is taught as a lecture course with student participation and use of calculators. 1. To illustrate and enhance concepts
2. To explore conjectures
3. To solve problems not usually attempted because of the amount of computation involved
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| 8. | Guidelines/Suggestions for Methods of Student Assessment (Student Learning Outcomes)1. Midterm (30% of the grade each)
2. Short quizzes, project (40% of the grade)
3. A cumulative final exam (30% of the grade)

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| 9. | Suggested Reading, Texts and Objects of Study:University Calculus Hass, Weir, Thomas, Pearson*University Calculus (Part Two: Multivariate)*, Hass, Weir and Thomas;                 Pearson: Addison-Wesley, 2007. |
| 10. | Bibliography of Supportive Texts and Other Materials:1. Marsden. E., Tromba, A. J. and Weinstein A., Basic Multivariate Calculus, Springer-Verlag, New York,
2. Anton, Howard, Calculus with Analytic Geometry, New York, New York, John Wiley and Sons,
3. Pao, K. and Soon, F., Student's Guide to Basic Multivariate Calculus, Springer-Verlag, New York.
4. Leithold, Louis, The Calculus with Analytic Geometry, 5th edition, New York, New York, Harper and Row.
5. Smith, David A., Interface: Calculus and the Computer, 2nd edition, new York, New York, CBS College Publishing.
6. Stewart, James, Calculus, Belmont, California, Brooks Cole Publishing Company.
7. Stroyan, K.D., Computer Explorations in Calculus, Orlando, Florida, Harcourt, Brace, Jovanovitch.
8. Swokowski, Earl W., Calculus with Analytic Geometry, Alternate Edition, Boston, Massachusetts: Prindle, Weber, and Schmidt.
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| 11. | Preparer’s Name and Date:Fall 2009 |
| 12. | Original Department Approval Date:Fall 1979 |
| 13. | Reviser’s Name and Date: |
| 14. | Departmental Revision Approval Date: |