**DEREE COLLEGE SYLLABUS FOR: MA 3345 CALCULUS III**

**US CREDITS: 3/1.5/4**

(Effective Fall 2021)

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| **PREREQUISITES:** | MA 1008 College Algebra<br>MA 2130 Calculus I<br>MA 2240 Calculus II |
| **CATALOG DESCRIPTION:** | A continuation of Calculus II. This is a study of multivariable calculus including vector-valued functions and the calculus of curves in space, differential calculus of multivariate functions, integral calculus of multivariate functions, spherical and cylindrical coordinates, line and surface integrals. |
| **RATIONALE:** | This mathematics module aims to introduce advanced calculus concepts and techniques in three dimensions that are necessary for calculus-based science and engineering courses. The knowledge gained in this course will provide students with important transferable skills required to use vector calculus in real-life applications. |
| **LEARNING OUTCOMES:** | Upon successful completion, the students should be able to:<br>1. Demonstrate understanding of the concepts of vectors in space and vector-valued functions.<br>2. Demonstrate ability to compute derivatives and integrals of vector-valued functions and solve related problems with various applications.<br>3. Apply multivariate differential calculus to solve max/min and approximation problems involving functions of several variables.<br>4. Demonstrate ability to compute multiple integrals and use them in various applications.<br>5. Demonstrate understanding of the concepts of calculus of multi-dimensional quantities and solve related problems with various applications. |
| **METHOD OF TEACHING AND LEARNING:** | In congruence with the teaching and learning strategy of the college, the following tools are used:<br>➢ Classes will consist of lectures where the concepts of the course will be introduced. Coursework will be regularly assigned and discussed in class with students actively participating in the discussion. Computer software will be available both as a teaching aid and as the medium for solving problems.<br>➢ Office hours: students are encouraged to make full use of the office hours of their instructor, where they can ask questions, see their exam paper, and/or go over lecture material.<br>➢ Use of a blackboard site, where instructors post lecture notes, assignment instructions, timely announcements, as well as additional resources. |
| **ASSESSMENT:** | **Summative:**<br>First Assessment: Midterm Examination — **40%** — Solving calculus exercises and word-problems, interpretation of results<br>Second Assessment: Portfolio — **10%** — Solving calculus problems using software, interpretation of results<br>Final Assessment: Final Examination — **50%** — Solving calculus exercises and word-problems, interpretation of results<br>**Formative:**<br>Online exercises and word problems assigned through Blackboard. — **0%** — Solving calculus exercises and word-problems, interpretation of results<br>▪ The first assessment (midterm exam) tests Learning Outcomes 1 and 2.<br>▪ The second assessment (portfolio) tests Learning Outcomes 2, 3, 4 and 5.<br>▪ The final assessment (final exam) tests Learning Outcomes 1, 2, 3, 4, 5.<br>▪ The formative assessment aims to prepare students for the examinations.<br><br>The final grade for this module will be determined by averaging all summative assessment grades, based on the predetermined weights for each assessment. Students are not required to resit failed assessments in this module. Failure to pass the module results in module repeat. |

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| **INDICATIVE READING:** | **REQUIRED READING:**<br>Ron Larson, Bruce Edwards, *Calculus: Early Transcendental Functions,* Cengage, © 2019, 7th Edition (International Metric Edition, WebAssign e-book)<br><br>**RECOMMENDED READING:**<br>• James Stewart, *Multivariable Calculus*, Cengage, © 2015, 8th Edition.<br>• Robert Smith, Roland Minton, *Calculus*, McGraw Hill, © 2011, 4th Edition. |
| **INDICATIVE MATERIAL:** | **REQUIRED MATERIAL:** N/A<br><br>**RECOMMENDED MATERIAL:**<br>• College Mathematics<br>• Mathematics Magazine<br>• American Mathematical Monthly |
| **COMMUNICATION REQUIREMENTS:** | Oral and written communication skills using academic / professional English. |
| **SOFTWARE REQUIREMENTS:** | Any software distributed with the course textbook.<br><br>Opensource math software *Scilab* (www.scilab.org) |
| **WWW RESOURCES:** | http://mathworld.wolfram.com<br>http://sosmath.com<br>https://www.khanacademy.org/math<br>https://www.symbolab.com |
| **INDICATIVE CONTENT:** | **1. The Geometry of Space**<br>1.1 Lines, planes, and surfaces in space<br>1.2 Cylindrical and spherical coordinates<br><br>**2. Vector-Valued Functions**<br>2.1 Space curves and vector-valued functions<br>2.2 Differentiation of vector-valued functions<br>2.3 Integration of vector-valued functions<br>2.4 Applications of vector-valued functions<br><br>**3. Functions of Several Variables**<br>3.1 Partial derivatives and differentials<br>3.2 Chain rule for one or two independent variables<br>3.3 Implicit partial differentiation<br>3.4 The directional derivative of a function of two variables<br>3.5 The gradient of a function of two variables and applications<br>3.6 Extrema of functions of two variables<br>3.7 Optimization problems involving functions of several variables<br>3.8 Constrained optimization: The Lagrange Multipliers method<br><br>**4. Multiple Integration**<br>4.1 Iterated integrals and area of a plane region<br>4.2 Double integrals and volume of a solid region<br>4.3 Double integrals in polar coordinates<br>4.4 Triple integrals in cylindrical and spherical coordinates<br><br>**5. Vector Calculus**<br>5.1 Vector fields and line integrals<br>5.2 The fundamental theorem of line integrals<br>5.3 Green's theorem and applications<br>5.4 Parametric and surface integrals<br>5.5 Divergence theorem and applications<br>5.6 Stokes's theorem and applications |