**MA1116 - VECTOR CALCULUS (3-0)**

**Prerequisite:** MA1115

**Text:** Calculus (Early Transcendentals), 6E Edition, by James Stewart, 2008, Thomson Brooks/Cole, ISBN 0-495-01166-6.

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| HOURS | TOPICS | SECTION HOMEWORK |
| **3-3** | Vector Fields | 16.1 3, 5, 6, 9, 11-14, 15-18, 23, 26, 29-32, 35 |
| **3-6** | Line Integrals | 16.2 1, 3, 5, 11, 17-19, 33, 41-43, 48 |
| **3-9** | Fundamental Theorem for Line Integrals | 16.3 1, 3, 5, 7, 13, 15, 19, 21, 23, 27, 30, 34a |
| **3-12** | Green’s Theorem | 16.4 2, 5, 9, 12, 13, 19, 21 |
| **3-15** | Curl and Divergence | 16.5 3, 5, 6, 9-11, 15, 17, 25, 31, 37, 38 |
| **3-18** | Parametric Surfaces and Their Areas | 16.6 3-6, 13-19, 23, 31, 33, 37, 41, 43 |
| **3-21** | Surface Integrals | 16.7 5, 13, 17, 21, 25, 27, 38, 42, 43, 45 |
| **3-24** | Stokes’ Theorem | 16.8 1, 4, 5, 9, 10, 13, 15, 17 |
| **3-27** | Divergence Theorem | 16.9 1, 4, 5, 7, 13, 17, 19, 23, 31, 32 |
| **1-28** | Summary | 16.10 Concept Check, True-False Quiz |
| **5-33** | Reviews, Exams, Holidays |  |

### Course Objectives

Upon completion of this course, the student should be able to:

* Sketch vector fields in two or three dimensions. Use them to represent particle displacement, gravitational force, fluid velocity, electric and magnetic fields, or the gradient of a scalar field.
* Evaluate the line integral of a scalar or vector field along a space curve. Calculate the mass and center of mass of a wire, or work done by a force field on a particle moving along a space curve.
* Determine whether or not a vector field is conservative. If it is, find the scalar potential function.
* Use the fundamental theorem for line integrals to evaluate the work done by a conservative vector field. Understand the law of conservation of energy and its application to orbital mechanics.
* Integrate both sides of the scalar form of Green’s Theorem. Understand the vector forms of Green’s theorem. Use line integrals to calculate area.
* Calculate the curl and divergence of a vector field, and the Laplacian of a scalar field. Give a physical interpretation of the curl and divergence of a velocity field.
* Sketch quadric surfaces and give their equations in implicit, explicit, or parametric form. Find the equations of the tangent planes or unit normal vectors to a surface.
* Use spherical or cylindrical coordinate systems for surfaces with appropriate symmetry.
* Find surface areas and evaluate surface integrals for surfaces given in parametric or explicit form. Calculate the mass and center of mass of a thin shell.
* Evaluate flux integrals. Calculate fluid, electric, or heat flux across a surface.
* Integrate both sides of Stokes’ theorem and both sides of the divergence theorem.
* Describe the similarities between the fundamental theorem of calculus, the fundamental theorem for line integrals, Green’s theorem, Stokes’ theorem, and the divergence theorem.