COURSE NAME AND CODE: Calculus II (MATH 1151)

LEVEL: I

SEMESTER: II

NUMBER OF CREDITS: 3

PREREQUISITES: Calculus I (MATH 1142)

RATIONALE:

Math 1151 is the second course in a two-semester sequence in calculus. The goal of this sequence is to provide students a basic foundation in calculus so that they will be adequately prepared for subsequent courses in mathematics, physics, and other scientific disciplines. Course objectives define the course goal with a finer level of granularity: to engage students to recall basic facts, accurately perform algorithmic computations, construct concepts, interpret vocabulary and notation, discovery relationships, apply all of the above to analyze and solve real-world and contrived problems relevant to various segments of course content. Many different applications will be considered in order to service the ever-expanding clientele, which includes many students outside the field of mathematics, physics, and engineering.

COURSE DESCRIPTION:

This is a Level I compulsory course for majors and minors in Mathematics, which is suitable for all science students. After MATH 1142, this course introduces functions of several variables, their limits and continuity, and partial differentiation. Double and triple integration are included with applications to find areas and volumes. It is a direct continuation of the Calculus I. Both courses, Calculus I and II, will prepare the students to the second year courses, which will give more rigorous study of limits, integration, series, and differential equations. Both calculus courses, Calculus I and II, provide the essential mathematical knowledge for starting the second year courses. Furthermore, students will be exposed to modern mathematical software (Math Lab, Maple or Mathematica) to explore the concepts encountered in the course.

CONTENT:

More Methods of Integration – Partial Differentiation – Multiple Integrals

OBJECTIVES:

At the end of the course, students will be able to:

- Integrate expressions containing radicals, trigonometric and hyperbolic functions, exponential functions and to apply the trigonometric and hyperbolic substitutions.

- Solve simple first order differential equations by separation of the variables.
- Compute partial derivatives of the functions of several variables, find the gradient vector. Compute directional derivatives.
- Apply partial differentiation to determine the maximum and/or minimum points for functions of two variables.
- Compute double integral over rectangular and triangular regions. Able to sketch more complicated regions and compute double integrals over them, interchanging the order of integration when appropriate.
- Translate a problem statement into a double integral where appropriate and solve problems requiring double integrals such as moment of inertia, center of mass, volume and area of a surface.

SYLLABUS

More methods of integration: [8 hours]

Integration of expressions containing radicals, integration of expressions containing trigonometric and hyperbolic functions and trigonometric substitutions; introduction of ordinary differential equation and application of integration in solving first order differential equations;

Partial differentiation: [10 hours]

Functions of several variables, gradient vector, directional derivatives, and the tangent plane, variation of parameters; polar, cylindrical and spherical coordinate; constrained and unconstrained optimization, including Lagrange multipliers;

Multiple integrals: [8 hours]

Double integrals, heuristics and reversing the order of integration; line, surface and volume integrals.

Tutorials: 15 hours

TEACHING METHODOLOGY

This course will be delivered by a combination of interacive lectures and participative tutorials. The total estimated 41 contact hours are broken down as follows: 26 hours of lectures, 15 hours of tutorials. The course material will be posted on the webpage

http://ourvle.mona.uwi.edu/

Practice problems and assignments will also be available to students via this webpage, as well as the solutions to the assignment questions after the due date.

ASSESSMENT

The course assessment will be divided into two components: a coursework component worth a 30% and a final exam worth a 70%.

- Two course work exams will take place during weeks 5 and 9. Each will be worth a 15% of the student's final grade.
- The final exam will be two hours in length and consist of compulsory questions.

REFERENCE MATERIAL:

Books:

1. S. Lang: A first course in Calculus, Springer Undergraduate Texts in Mathematics, 5th Edition, 2005

   - Serge Lang's text teaches the skills needed to solve challenging calculus problems, while teaching to think mathematically. The text is principally concerned with how to solve calculus problems. Key concepts are explained clearly. Methods of solution are effectively demonstrated through examples. The challenging exercises reinforce the concepts, while enabling to develop the skills required for solving hard problems. Answers to the majority of exercises (not just the odd-numbered ones) are provided in a hundred page appendix.

2. M. Spivak: Calculus, Cambridge University Press, 3rd Edition, 2008.

   - This book combines leisurely explanations, a profusion of examples, a wide range of exercises and plenty of illustrations in an easy-going approach that enlightens difficult concepts and rewards effort.

2. M. Comenetz: Calculus: the elements. World Scientific Publishing, 2002

   This is by far the best book grasping and retaining the fundamentals of calculus. It starts a topic by building from the most basic and expands it to a conclusion. The text uses numerous technical applications to help in conveying the concepts. The student reading this book must of course dedicate the time and effort to fully understand the concepts. Proofs are used throughout and provide added value to those so inclined to have a rigorous presentation.

Online Resources:

http://www.math.temple.edu/~cow - A collection of auto-scoring calculus modules organized into books, chapters, and sections, with help and hints for the problems. Modules with asterisks (including chain rule, Taylor polynomials, Riemann sums, and arc length) allow you to change values and see the effect. Book I: functions and geometry; limits and continuity; the derivative; techniques and theory of differentiation; applications of the derivative; and integration. Book II: integration; applications of integration; transcendental functions; methods of integration; geometry, curves, and polar coordinates; and sequences and series. Book III: sequences and series; vectors and analytic geometry; curves; functions; and integration. Registered students can log in for a session in which their work will be recorded and graded.

http://www.sosmath.com/calculus/calculus.html - An online course: learning units presented in worksheet format review the most important results, techniques and formulas in college and pre-college calculus. Logarithms and Exponential; Sequences; Series; Techniques of Integration; Local Behavior of Functions; Power Series and much more; and an Appendix of Mathematical Tables.

http://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx - online notes for Calculus II taught at Lamar University. They are accessible to anyone wanting to learn Calculus II or needing a refresher in some of the topics from the class.