### MTH1202 – Calculus I

**COURSE CODE: MTH 1202**

**COURSE TITLE: CALCULUS I**

**CREDITS: 4 Lecture hours 4 Tutorial hours 1**

**COURSE DESCRIPTION**

This is a course for first-year students in mathematics, science, or engineering. It is the first of a two-course sequence serving as a basic and sound introduction to the single-variable calculus. This course covers the intuitive ideas and formal processes of differentiation and integration. The emphasis, however, is on differentiation and its applications (Integration is emphasized in the second course). The ideas and processes of calculus are applied to produce standard algorithms for differentiating and integrating functions that mathematicians and scientists frequently encounter. They are also applied to problems in maxima and minima or areas and volumes of the type mathematicians and scientists frequently encounter. Students completing the sequence in one-variable calculus (MTH 1202 and MTH 2101) are qualified for multivariate calculus (MTH 2201) and analysis (MTH 2103).

This course, together with MTH 2101, is particularly helpful in preparing students for the BSc in Mathematics. This course is also helpful in preparing students for the employment sector, as many employers now require a working knowledge of calculus.

**PRE-REQUISITES/CO-REQUISITES/FOLLOW-ON COURSES:**

**PRE-REQUISITES:** MTH 1101 - Algebra

**CO-REQUISITE:** MTH 1204 - Analytic Geometry and Trigonometry II

**FOLLOW-ON COURSES:**MTH 2101 – Calculus II, MTH2103 – Analysis I, MTH 2204 – Discrete Mathematics

**STUDENT LEARNING OUTCOMES**

On successful completion of the course, students should be able to:

1. Differentiate the standard functions in calculus in a reliable and efficient way.
2. Solve maxima, minima, and similar problems using the differential calculus.
3. Integrate the standard functions in calculus by applying the laws of calculus.
4. Solve elementary and typical problems on exponential and logarithmic growth with calculus.
5. Apply calculus to related rates, differential equations and area.

**COURSE CONTENT**

Intuitive motivation for the derivative of a function. Definition of the derivative. Laws of differentiation: sums, differences, products and quotients. Elementary instances of the chain rule. Maxima and minima, higher-order derivatives and their interpretation. Equation of tangent and normal. Graphing functions. Limits and continuity. Rates of change.

The Mean-Value theorem and L’Hopital’s rule. The chain rule (general case). Inverse functions, the inverse trigonometric functions. Implicit and parametric differentiation.

Intuitive motivation for the integral of a function. The definite integral.

Antidifferentiation and the Fundamental Theorem of Calculus. Integral of polynomials, rational and trigonometric functions. Indefinite integrals and the method of substitution.

Definite integration and area under a curve. Area bounded by two curves. Numerical integration. Introduction to differential equations; related rates.

Calculus of the logarithmic and exponential functions. Hyperbolic functions and their calculus.

**METHODS OF TEACHING**

* Lecturing
* Small Group Teaching
* Discussion and problem solving
* Using computer and other technology

Instructors will introduce new topics with whole-group lectures that motivate students to become involved with the topic, (for example, these may refer to historical considerations or the role of mathematics in new technologies). They will then present the topics in a logical and coherent way, ensuring that students achieve a basic understanding of the processes of calculus. Students’ progress will be monitored with a regular set of individual or small-group exercises that will be included in the assessment.

**METHODS OF ASSESSMENT**

Coursework (Two Tests-30%, Assignment(s) and Quizzes -10%) 40%

Final Exams (one 2-hour paper) 60%

**REQUIRED READING:**

Strang, G. (2010). *Calculus* (2nd ed.). Wellesley, MA: Wellesley-Cambridge. ISBN 978-0-980232-74-5.

**RECOMMENDED READING:**

Lang, S. (1986). *A First Course in Calculus*. Berlin: Springer. ISBN 978-0-387-96201-6.

**WEB RESOURCES**

The Khan Academy offers algebra modules and courses which support this course. Students can work at

their own pace and monitor their progress in each module. ([www.khanacademy.org/math](http://www.khanacademy.org/math))

The Massachusetts Institute of Technology maintains a website offering many teaching and learning

resources for university-level courses. These include a PDF file containing an earlier version of the course text. This may be accessed at ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf.