APPENDIX A

MATH 1006 – Calculus for the Life Sciences

Course description MATH 1006. Calculus for Life Sciences is an introduction to differential calculus, including algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions. Applications include biomechanics, ecology, infectious diseases, physiology, and modelling.

Course format The course is delivered as 4 x 1 hour lectures per week.

Course expectations: Students are expected to attend all classes. Any students that are disruptive, violating university policies, or acting in a potentially unsafe way will be warned and asked to leave.

Learning goals

- Can solve problems relevant to the course material
- Understands the relevance of course concepts to the life sciences
- Appreciates the relevance of mathematics to modelling in the life sciences
- Some knowledge of how to use software to support understanding and verify calculations

Required Text and Readings
The course will cover Chapters 2-4 of Biocalculus: Calculus for the Life Sciences by James Stewart and Troy Day. Some concepts will be illustrated with freely available software (also available in the Henrietta Harvey computer lab). Course announcements and materials will be made of BrightSpace.

Method of evaluation
Weekly assignments: 15%
Midterm 1 (mid-Oct): 15%
Midterm 2 (mid-Nov): 15%
Final Exam: 55%

The Department of Mathematics and Statistics offers supplementary examinations for first and second year courses to students who are in clear academic standing, who have a passing term mark, and whose final grade is between 45 and 49 (inclusive). Application for supplementary examinations must be made within 5 working days of the release of marks in any semester. Regulations governing supplementary exams are in section 8 of the Faculty of Science Calendar.

Late assignments and missed midterms, and final exams will be accommodated as described by University Regulation 6.7.3 and 6.7.5 (see https://www.mun.ca/regoff/calendar/sectionNo=REGS-0474 for Regulations). The Final exam will cover all Lecture material. Specific regulations governing final examinations are described by University Regulation 6.8.

Course outline

UNIT 1: LIMITS, Chapter 2 of Stewart and Day 2015

1.1 Limits of Sequences
- *Logistic sequence, dynamics of viral infections*

1.2 Limits of functions at infinity
- *Monod growth function*

1.3 Limits of functions at finite numbers

1.4 Limits: Algebraic methods

1.5 Continuity

Host, parasites and time-travel

UNIT 2: DERIVATIVES, Chapter 3 of Stewart and Day, 2015

2.1 Derivatives and rates of change
- *Measuring the rate of increase in blood alcohol concentrations*

2.2 The derivative as a function

2.3 Basic differentiation formulas

2.4 Product and Quotient rules

2.5 The Chain rule

2.6 Exponential Growth and Decay
- *Population growth, Radioactive decay, Newton's law of cooling, controlling Red Blood Cell Loss during surgery*

2.7 Derivatives of the logarithmic and inverse tangent functions

2.8 Linear approximations and Taylor polynomials
- *Harvesting renewable resources*

Kill curves and antibiotic effectiveness

UNIT 3: APPLICATIONS OF DERIVATIVES, Chapter 4 of Stewart and Day, 2015

3.1 Maximum and minimum values
- *The calculus of rainbows*

3.2 How derivatives affect the shape of a graph

3.3 L'Hospital's rule: comparing rates of growth
- *Mutation-selection balance in Genetic Diseases*

3.4 Optimizing problems
- *Flapping and Gliding*
- *The tragedy of the commons: an introduction to game theory*

3.5 Recursions: equilibria and stability

3.6 Antiderivates

Additional Policies

Accommodation of students with disabilities

Memorial University of Newfoundland is committed to supporting inclusive education based on the principles of equity, accessibility and collaboration. Accommodations are provided within the scope of the University Policies for the Accommodations for Students with Disabilities (www.mun.ca/policy/site/policy.php?id=239). Students who

may need an academic accommodation are asked to initiate the request with the Glenn Roy Blundon Centre at the earliest opportunity (www.mun.ca/blundon).

Academic misconduct
Students are expected to adhere to those principles, which constitute proper academic conduct. A student has the responsibility to know which actions, as described under Academic Offences in the University Regulations, could be construed as dishonest or improper. Students found guilty of an academic offence may be subject to a number of penalties commensurate with the offence including reprimand, reduction of grade, probation, suspension or expulsion from the University. For more information regarding this policy, students should refer to University Regulation 6.12.

Equity and Diversity
A safe learning environment will be provided for all students regardless of race, colour, nationality, ethnic origin, social origin, religious creed, religion, age, disability, disfigurement, sex (including pregnancy), sexual orientation, gender identity, gender expression, marital status, family status, source of income or political opinion.

You should not photograph or record myself, teaching assistants, or other students in the class without first obtaining permission. Accommodation will be made for students with special needs.

The sound should be turned off on phones and computers during class.

Additional Supports
Resources for additional support can be found at:

- www.mun.ca/currentstudents/student/
- https://munsu.ca/resource-centres/

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Table 1. Comparison of MATH 1000 and 1006 Course outlines. Within unit ordering is different. Content differences are underlined

MATH 1006	**MATH 1000** (Fall 2016/Fall 2022 Instructor Dr. Danny Dyer)
UNIT 1: LIMITS	**UNIT 1: LIMITS**
1.1 Limits of Sequences	1.1 The limit of a function
1.2 Limits of functions at infinity (includes limits of the exponential function-vertical, monod growth function -horizontal)	1.2 Calculating limits using the limit laws
1.3 Limits of functions at finite numbers	1.3 Evaluating limits; vertical asymptotes
1.4 Limits: Algebraic methods (incl. limit laws)	1.4 Continuity
1.5 Continuity	1.5 Limits at infinity horizontal asymptotes
UNIT 2: DERIVATIVES	**UNIT 2: DIFFERENTIATION**
2.1 Derivatives and rates of change (incl. tangents)	2.1 Tangent and velocity problems
2.2 The derivative as a function (incl. higher order derivatives)	2.2 Derivatives
2.3 Basic differentiation formulas (incl. power, exponential, sine and cosine)	2.3 Derivates of polynomial and exponential functions
2.4 Product and Quotient rules (incl. trigonometric functions)	2.4 The product and quotient rules
2.5 The Chain rule (incl. implicit differentiation)	2.5 Derivatives of trigonometric functions
2.6 Exponential Growth and Decay	2.6 The chain rule
2.7 Derivatives of the logarithmic and inverse tangent functions	2.7 Implicit differentiation
2.8 Linear approximations and Taylor polynomials	2.8 Derivatives of logarithmic functions
	2.9 Inverse trigonometric functions and their derivatives
	2.10 Hyperbolic functions and their derivatives
	2.11 Higher order derivatives
UNIT 3: APPLICATIONS OF DERIVATIVES	**UNIT 3: APPLICATIONS OF DERIVATIVES**
3.1 Maximum and minimum values	3.1 Rectilinear motion and related rates
3.2 How derivatives affect the shape of a graph (incl. mean value theorem)	3.2 Maximum and minimum values
3.3 L'Hospital's rule: comparing rates of growth	3.3 The mean value theorem
3.4 Optimizing problems	3.4 How derivatives affect the shape of the graph
3.5 Recursions: equilibria and stability	3.5 Summary of curve sketching
3.6 Antiderivates	3.6 Optimization problems
	3.7 L'Hopital's rule