OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE:	September 2012
COURSE REVISED IMPLEMENTATION DATE:	
COURSE TO BE REVIEWED:	March 2018
(six years after UEC approval)	*(month, year)*

OFFICIAL UNDERGRADUATE COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department – see course syllabus available from instructor

MATH 118	SCIENCE/MATHEMATICS & STATISTICS	4
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Calculus II for Life Sciences
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

In this course we study the problem of how to determine a quantity given only knowledge of its rate of change. After learning the solution to such a problem, we will apply the tools of calculus to modeling systems in biology. Topics include the definite integral; interpretation and application of the definite integral; improper integrals and their applications; an introduction to differential equations; an introduction to numerical techniques of integration; analysis of models describing population dynamics, epidemics, genetics, chemical reactions, and excitable tissue.

Note: Students may receive credit for only one of MATH 112, MATH 118, and MATH 116.

PREREQUISITES:	MATH 111 with a C or better
COREQUISITES:	
PRE or COREQUISITES:	BIO 112

SYNONYMOUS COURSE(S):

(a) Replaces:
(b) Cross-listed with:
(c) Cannot take: MATH 116, MATH 112 for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **60**

STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		Hrs
Field experience:		Hrs
Student directed learning:		Hrs
Other (specify):		Hrs

TRAINING DAY-BASED INSTRUCTION:
Length of course:
Hours per day:

OTHER:
Maximum enrolment: **36**
Expected frequency of course offerings: Fall & winter semesters. May be offered in Summer according to demand & funding
(every semester, annually, every other year, etc.)

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☒ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☐ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

Course designer(s): **Bio-Calculus Group**	
Department Head: **Greg Schlitt**	Date approved: **October 31, 2011**
Supporting area consultation (Pre-UEC)	Date of meeting: **February 3, 2012**
Curriculum Committee chair: **Norm Taylor**	Date approved: **January 27, 2012**
Dean/Associate VP: **Ora Steyn**	Date approved: **February 10, 2012**
Undergraduate Education Committee (UEC) approval	Date of meeting: **March 2, 2012**

LEARNING OUTCOMES:

The main objectives of this course are to learn how to compute and interpret the definite integral, and use the tools of calculus to perform basic analysis of mathematical models in biological settings.
Building upon their knowledge of differential calculus, successful students will:
1. Demonstrate competence with the fundamental techniques of integration.
2. Develop and evaluate definite and improper integrals arising in a variety of situations in biology.
3. Set up and solve elementary differential equations (DEs) using graphical, numerical and analytical techniques.
4. Apply their knowledge of DEs to solve basic growth and decay problems.
5. Perform qualitative analysis on systems of DEs by finding equilibria, nullclines, and determining stability properties.
6. Apply their knowledge of DEs to construct, interpret, and criticize models of biological phenomena

METHODS: *(Guest lecturers, presentations, online instruction, field trips, etc.)*

Lectures are interspersed with problem sessions; evaluation includes assignments, midterms, and a three-hour comprehensive final. Graphing calculators will be used. In addition, mathematical software may be used.

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

☐ Examination(s) ☐ Portfolio assessment ☐ Interview(s)

☒ Other (specify): Course challenge.

TEXTBOOKS, REFERENCES, MATERIALS: *[Textbook selection varies by instructor. Examples for this course might be:]*

Calculus for the Life Sciences. Bittinger, Brand & Quintanilla
Calculus for the Life Sciences, Modeling the Dynamics of Life, Adler & Lovric

SUPPLIES / MATERIALS:

STUDENT EVALUATION: *[An example of student evaluation for this course might be:]*

The weighting of the various components may vary from instructor to instructor and from year to year, although there must be at least two midterms, and the comprehensive final exam must be worth from 30% to 50% of the final grade. Students must obtain at least 40% on the final exam to pass the course.
An example of student evaluation for this course:

Quizzes/Assignments	10%
Project	15%
Midterm Exams	35%
Final Exam	40%

COURSE CONTENT: *[Course content varies by instructor. An example of course content might be:]*

Exact course content and ordering may vary slightly from year to year but will encompass the following:

I. Definite Integral:
   1. brief review of derivatives and antiderivatives
   2. integration by substitution
   3. integration by parts
   4. numerical integration* including Riemann sums, trapezoidal and midpoint rules, Simpson's rule
   5. improper integrals

II. Applications: constructing Riemann sums and evaluating integrals in a wide variety of settings, including
   1. area and volume
   2. applications biology such as integrals of population densities or concentrations

III. Differential Equations
   1. slope fields
   2. Euler's method
   3. separation of variables
   4. stability of equilibria
   5. analysis of systems using nullclines

IV. Models in biology
   1. single species populations
   2. interacting species (predator prey, competition models)
   3. epidemic models
   4. replicator dynamics
   5. excitable systems