Master Syllabus for Math 136

PREREQUISITE: A grade of C or better in Math 125

COURSE DESCRIPTION AND OBJECTIVES: MAT 136 is a four credit course meeting 200 minutes each week. It applies toward the Science/ Applied Science distribution block in the University Liberal Studies Program.

STUDENT LEARNING OUTCOMES: MAT 136 presents the concepts, methods and applications of elementary calculus, and discusses how these tools are used for increasing understanding of the physical and social environment of humanity. Students will learn to apply differentiation and integration in setting up and critically evaluating hypotheses in the fields of science, engineering and technology, and how to effectively describe their mathematical results in written and oral form. They will learn how analytic, graphical, and numerical approaches to Calculus enhances their understanding of scientific models of phenomena and clarifies their range of applicability. They will learn how to use the ideas and methods of Calculus to create models of a number of physical and social phenomena, which assumptions underlie the models, and how to use differentiation and integration to derive predictions from these models.

In particular, with regard to liberal studies, MAT 136 will address the essential skills of critical thinking, quantitative analysis and use of technology.

APPROACH: This course will use a mix of lecture, discussion, class participation and group activities according to instructor design. In addition, students will regularly use technology in the form of computer packages (e.g., Mathematica, Mathcad) or graphing calculators.

POSSIBLE TEXTS:
1) Online calculus text http://www.whitman.edu/mathematics/multivariable/
2) Online calculus text http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx
3) Stewart: Calculus – Concepts and Contexts

More resources available at http://jan.ucc.nau.edu/~ns46/Calc/
We use the department WeBWorK system for Homework: https://webwork.math.nau.edu/
COURSE OBJECTIVES:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Express understanding of and related interpretations of the concepts of limit, derivative and integral in writing and via computations, graphs, numerical values and mathematical symbolism. (Technology and its impact, environmental consciousness, critical thinking, quantitative analysis, use of technology)</td>
<td>Examination questions, technology projects. Some may also use writing assignments, homework, or quizzes.</td>
</tr>
<tr>
<td>2. Calculate exactly or approximate as appropriate limits, derivatives and integrals from formulas, tables, and graphs. (Technology and its impact, quantitative analysis, use of technology)</td>
<td>Examination questions, gateway exam, technology projects. Some may also use homework or quizzes.</td>
</tr>
<tr>
<td>3. Apply the derivative to analyze graphical behavior, motion problems, other rate problems and optimization problems. (Technology and its impact, environmental consciousness, critical thinking, quantitative analysis, use of technology)</td>
<td>Examination questions and technology projects. Some may also use applied projects, homework, or quizzes.</td>
</tr>
<tr>
<td>4. Apply the definite integral to analyze motion problems, change and rate of change problems and area problems. (Technology and its impact, environmental consciousness, critical thinking, quantitative analysis, use of technology)</td>
<td>Examination questions and technology projects. Some may also use applied projects, homework, or quizzes.</td>
</tr>
</tbody>
</table>

ASSESSMENT AND GRADES:

1. Homework will be regularly assigned from WebWork (or other sources), with some problems graded.
2. There will be 3 or 4 tests, and possibly quizzes, at the discretion of the instructor.
3. Assessment percentages may vary with instructors; the following is representative:
   - Homework, Quizzes, and Projects: 20%
   - Tests: 60%
   - Comprehensive Final Exam: 20% (minimum)

Grades will be based on a percentage not deviating significantly from the following scale:
   - A: 90-100%
   - B: 80-89%
   - C: 70-79%
   - D: 60-69%
   - F: 0 – 59%

COURSE OUTLINE: Possible timeline:

1. Functions and Models - 4-6 days
   - Review of functions including linear, exponential, power, logarithmic, trigonometric, polynomial and rational functions. Inverse functions, compositions and transformations, and modeling.
2. Limits and Derivatives - 12-13 days
   Development of the notion of derivative via tangents and velocity. Limits of a
   function, limit laws, limits involving infinity, continuity, tangents, velocity and other
   rates of change, formal derivatives as functions, linear approximations, relationships
   between properties of a function and its derivative, rate of change and velocity, law of
   falling bodies in a constant gravitational field.

3. Differentiation Rules -10-11 days
   Derivatives of Polynomial, Exponential, Trigonometric and Logarithmic Functions;
   Product and Quotient Rules, the Chain Rule, Implicit Differentiation, Linear
   Approximations, Population Growth models.

4. Applications of Differentiation - 11-12 days
   Related rates, Maxima/Minima, creation and analysis of graphs of functions,
   Indeterminate forms and L’Hospital’s Rule, Applied optimization problems,
   Antiderivatives with applications to the analysis of motion.

5. The Integral - 13-14 days
   Computation of areas and distances, Definite Integrals, Fundamental Theorem of
   Calculus, Substitution, integral approximations.

LEARNING PORTFOLIO
Writing assignments or project reports would be appropriate choices for the
learning portfolio, if either is part of the section requirements.

COMPUTER LAB FEE
The course carries a fee for the use of the Department of Mathematics and Statistics computer
lab.

COURSE POLICIES:

1. Regular attendance is expected. Normally no provisions will be made to accommodate students who
   miss class without valid institutional excuses.
2. Tests are graded according to work displayed. Correct answers without supporting work will be
   given no credit.
3. Assignments will not be accepted after the deadline.
4. Missed exams and quizzes may not normally be made up without an institutional excuse or an
   absence authorized by University Policy. Any predictable absence must be discussed with the
   instructor in advance.
5. Students will take the final on the scheduled day.
6. Drops must be processed by the Drop Deadline.
7. Individual instructors may require a calculator.
8. University policies: Students are responsible for the following policies: Safe environment, Students
   with Disabilities, Institutional Review Board, Academic Integrity, and Academic Contact Hour. A
   copy of these policies may be downloaded from the web site:
   http://jan.ucc.nau.edu/academicadmin/plcystmt.html. In addition, we have Departmental Policies

Revised 8/10