Program Cover Document --- MAT 128: Calculus B

I. Basic Course Information

MAT 128: Calculus B will be scheduled for three lecture periods: two periods of 80 minutes length and one one-hour meeting period. MAT 127 or MAT 125 (with chair's permission) is a prerequisite.

II. Learning Goals

The primary emphasis of Calculus B is on learning the second-half of single-variable calculus. Its subject matter is part of the foundation that many higher-level courses in mathematics, science, and engineering are built upon.

The major topics covered are techniques of integration, applications of integrals, an introduction to differential equations, and sequences and series. Upon completion of the course, we expect students to show competence with the ideas of calculus and its calculations, to understand how to apply calculus to solve real-world problems, to exhibit an improved ability to describe a real-world problem mathematically, to have an increased mathematical maturity, and to have an improved ability to read, write, and understand mathematics. These performance goals are in agreement with the department's program goals.

In Calculus B, students will gain exposure to both the theoretical and applied aspects of calculus. By working on many real-life problems, students will gain an appreciation for the practical applications of calculus. Simultaneously, their mathematical maturity will be built up through the presentation of theory and the expectation of a higher level of reasoning than has previously been demanded in their mathematics courses. They are also exposed to the concepts and techniques of problem solving through individual and group work on the exercises.

Calculus B, together with its predecessor MAT 127: Calculus A, serves as a bridge course between the high-school and college mathematical curricula. College level mathematics, science, and engineering courses demand a higher level of quantitative reasoning than that demanded in the high school curriculum. As many of our students enter with AP credit and will be taking Calculus B as their first mathematics course at the College, an important goal of Calculus B is to raise the level of their mathematical reasoning skills to the collegiate level.

III. Student Assessment

Students will receive regular feedback on their work through the assignment of homework, quizzes, student presentations and examinations. Through this feedback, students will be able to see and correct their misunderstandings and improve their performance. Student performance on these assessment instruments and the performance of students in their future courses such as Calculus C will be used to assess the success of Calculus B in achieving its learning goals and its contribution to the fulfillment of the department's program goals. Peer reviews and student evaluations will also be used to evaluate the course.

IV. Learning Activities

Learning activities will consist of a combination of lectures, group work, student presentations, and computer assignments. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and group homework to achieve the learning goals. These learning activities are typical of the learning activities in the department's major programs. By giving students a multitude of ways to learn and do mathematics, the learning activities

promote a deeper understanding of the concepts of calculus and contribute to the learning goals of these programs.

Course Syllabus Guide -- MAT 128: Calculus B

Introduction: A typical syllabus for Calculus B follows this sheet. Any syllabus for Calculus B should include the points listed below (the required course requirement sections) and use the recommended topics list as the basis for decisions on the course content.

I. Basic information on course and instructor

A. Purpose statement: Calculus B, the second half of the single-variable calculus experience, is a foundational course for the mathematics, science, and engineering curricula. It introduces students both to calculus and the higher expectations of college-level mathematics courses. Calculus B should also inspire mathematical curiosity and interest in its students.

B. Course description: A second course in calculus covering integral calculus and series. The course will cover both the theoretical and applied aspects of Calculus.

C. Course prerequisites: MAT 127: Calculus A or MAT 125 (with permission of the chair).

II. Learning goals

This course aims to develop student proficiency in the understanding of calculus concepts through numerical, graphical and functional analyses.

The course should be taught in a manner that develops and exhibits the following mathematical practices. Students in MAT 128: Calculus B should:

- Engage with the subject matter as they progressively grow in mathematical maturity and expertise throughout the sequence.
- Be able to address and demonstrate understanding of rigorous problems in multiple representations;
- Be able to explain and justify their solutions (including discussing them with other students),;
- Be able to apply mathematics to real-life applications;
- Be able to express their thought process and solution strategies in clear, written form.
- Be exposed to the purposeful and appropriate use of technology in the course.

A. Learning Goals: MAT 128 will focus on an in depth understanding of:

a. Concept of integration and its importance in geometric topics such as volumes and other applications of integration
b. Techniques of integration
c. Improper integrals and indeterminate forms
d. Concept of infinite sequence including their convergence properties
e. Concept of infinite series including their convergence properties
f. Concept of infinite series in approximation of polynomials and their use in representing functions as power series and Taylor series
g. Polar coordinate systems and curves defined by parametric equations
h. Students should be able to demonstrate understanding of multiple (numerical, graphical and algebraic) representations of a calculus problem.
i. Students should be able to justify their thought processes and solutions in clear, written form.
j. Students should be able to solve a real-life problem involving calculus.

Students will gain experience in communicating calculus topics utilizing mathematical language. The course will cover the topics listed on the attached "Calculus B Topics List" with the indicated emphases.

B. Learning Outcomes: Through solving rigorous problems and presenting written solutions clearly on formal and informal assessments, students will be able to demonstrate mastery of concepts involving:
    a. Utilize integration techniques to solve problems
    b. Use algebraic techniques such as partial fractions, substitutions, and integration by parts to evaluate integrals
    c. Use the concept of limits to evaluate improper integrals and indeterminate forms
    d. Determine convergence of infinite sequences and infinite series
    e. Use Taylor series for approximation purposes.
    f. Convert between rectangular and polar coordinates.
    g. Curves defined by parametric equations.
    h. Students should be able to demonstrate understanding of multiple (numerical, graphical and algebraic) representations of a calculus problem.
    i. Students should be able to justify their thought processes and solutions in clear, written form.
    j. Students should be able to solve a real-life problem involving calculus.

III. Student assessment

A. Assessment plan: Students will receive regular feedback on their work through the assignment of homework, quizzes, student presentations and examinations. The department has created a set of computerized homework problems (currently using the WeBWorK system) that all professors are required to assign to students. The amount of weight given to these homework problems is at the discretion of the instructor. A syllabus should clearly describe the schedule for these assessment tools and how they will be used to calculate grades.
B. Rationale: Students need to be able to use calculus correctly in their future courses. Through the use of regular feedback from homework, quizzes, student presentations and examinations, students will be able to see and correct their misunderstandings and improve their performance.
C. Methods and criteria: We will use the assessment of homework, quizzes, student presentations, and examinations to evaluate student accomplishment of the course learning goals. These assessment tools are similar to the manner in which students will need to display their knowledge of calculus in the future and are an appropriate way to assess the accomplishment of course learning goals.

IV. Learning activities

A. Summary of learning activities: Learning activities will consist of a combination of lectures, group work, student presentations, and computer assignments. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and group homework to achieve the learning goals.
B. Calendar or outline: A guide to the organization of the course, a schedule of assessment tools, and a plan for the coverage of topics should be provided to the students. As an approximate guide, 1-2 topics on the recommended list can be covered in a class period. Homework, quizzes, and examinations should be spaced at appropriate intervals throughout the semester.
C. Rationale: By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of the concepts of calculus and contribute to the learning goals of these programs. A regular spacing of assessment tools insures that students receive continual regular feedback on their work.

Calculus B Topics List

All listed topics are to be covered. Topics in bold should be covered in depth. The chapter numbers correspond with Stewart's *Calculus: Early Transcendentals* book.

Chapter 6:

6.2: Volume as Integral of Cross-Sectional Area, Volumes of Revolution (Discs)

Chapter 7:

7.1: **Integration by Parts**
7.2: Trigonometric Integrals (sine and cosine cases especially)
7.3: **Trigonometric Substitution**
7.4: **The Method of Partial Fractions**
7.5: Strategy for Integration
7.7: Numerical/Approximate Integration
7.8: **Improper Integrals**

Chapters 8 and 9 (approximately one week):

8.1: Arc Length
Applications of the Integral (Instructor Choice): Possible topics include:
8.2: Area of a Surface of Revolution
8.3: Fluid Pressure and Force, Moments and Centers of Mass
9: Solutions of Differential Equations

Chapter 10:

10.1: **Parametric Equations**
10.2: Tangent Lines for Parametric Equations, Arclength for Parametric Equations, Area under Curve Expressed as a Parametric Equation
10.3: **Polar Coordinates**
10.4: Arclength in polar coordinates

Chapter 11:

11.1: **Sequences**
11.2: **Geometric Series, Telescoping Series, Convergence/Divergence of Infinite Series, Test for Divergence**
11.3: **Integral Test, p-series,** Remainder estimate for the integral test
11.4: **Comparison Test, Limit Comparison Test**
11.5: **Alternating Series Test,** Remainder Estimate for Alternating Series
11.6: **Absolute and Conditional Convergence, Ratio Test,** Root Test
11.7: **Strategy for Testing Series**
11.8: **Power Series**
11.9: **Representations of Functions as Power Series**
11.10: **Taylor and Maclaurin Series,** Remainder Formulas for Taylor Series, Binomial Series

MAT 128 Calculus B **Spring 2018**

PROFESSOR: Karen Clark
OFFICE: 203 Science Complex
PHONE: (609)771-2019
EMAIL: KCLARK@TCNJ.EDU

OFFICE HOURS: Tuesdays and Fridays 12:30-1:30, Wednesdays 10:00-11:00, and by appointment. Students may make an appointment by sending me an email.

CLASS MEETINGS: Tuesdays and Fridays 9:30-10:50 & Wednesdays 9:00-9:50**.** All classes meet in room SCP 229.

Course Description: A second course in Calculus covering integral calculus and series. The course will cover both the theoretical and applied aspects of calculus. One course unit. Prerequisite is MAT 127, or MAT 125 with the permission of the Department Chair.

Course Materials: The text for the course is "*Calculus, Early Transcendentals*", 8th Edition, by James Stewart. You may find it useful to have a scientific calculator and calculators may be used on homework and during class. You may **not** use a calculator on exams or quizzes. You must have the code provided by the publisher to use WebAssign for homework assignments.

Course Requirements: Students are expected to read the appropriate section in the textbook after each lecture.

Homework using WebAssign: There will be weekly online homework which will generally be assigned on Tuesdays and will be due one week later. The homework will be completed using WebAssign. The numbers and functions in each assignment will be randomized for different students. Students will typically have 20 attempts to answer each question. If you get to 10 attempts and are still having trouble, you should contact me for help. Unless I have indicated otherwise (occasionally I will do this), **you may not use a graphing calculator, Wolfram Alpha, Mathematica, or anything similar for the WebAssign problems**. Students may submit homework up to three days late, with a 20% penalty.

Suggested problems: I will post a list of additional suggested practice problems from the text. It is strongly recommended that students do these problems and check the answers in the back of the book to prepare for exams.

Tests: There will be six tests, one approximately every two weeks. Test questions will in general be more difficult than homework questions. If you are ill and unable to attend a test a makeup can be arranged only if you call my office or email me before the start of the exam, and if you get a doctor's note. Makeups will be more difficult than the original.

Final: There will be a cumulative final exam at the end of the semester. Final exams are scheduled for May 8-15.

Course Purpose & Learning Goals: The primary emphasis of Calculus B is on learning the second-half of single-variable calculus. Its subject matter is part of the foundation that many higher-level courses in mathematics, science, and engineering are built upon.

The major topics covered are techniques of integration, applications of integrals, an introduction to differential equations, and sequences and series. Upon completion of the course, we expect students to show competence with the ideas of calculus and its calculations, to understand how to apply calculus to solve real-world problems, to exhibit an improved ability to describe a real-world problem mathematically, to have an increased mathematical maturity, and to have an improved ability to read, write, and understand mathematics. These performance goals are in agreement with the department's program goals.

In Calculus B, students will gain exposure to both the theoretical and applied aspects of calculus. By working on many real-life problems, students will gain an appreciation for the practical applications of calculus. Simultaneously, their mathematical maturity will be built up through the presentation of theory and the expectation of a higher level of reasoning than has previously been demanded in their mathematics courses. They are also exposed to the concepts and techniques of problem solving through individual and group work on the exercises. Calculus B, together with its predecessor MAT 127: Calculus A, serves as a bridge course between the high-school and college mathematical curricula. College level mathematics, science, and engineering courses demand a higher level of quantitative reasoning than that demanded in the high school curriculum. As many of our students enter with AP credit and will be taking Calculus B as their first mathematics course at the College, an important goal of Calculus B is to raise the level of their mathematical reasoning skills to the collegiate level.

Students are expected to keep current with the homework assignments, and to review material in groups as much as possible. The homework assignments are meant to provide a means to solve problems based on the material discussed in lecture. I will periodically break the class up into groups during lecture time to work on problems to be presented to the class. I encourage regular feedback from students if you are struggling with a particular topic.

Course Schedule:

The tentative dates for the tests are:
Wed February 7, Wed February 21, Wed March 7, Wed March 28, Wed April 11, and Wed April 25.
Midterm progress reports are due on Thursday March 22 and the last day to withdraw from a class is Friday March 23.

We will cover the following sections in the text (not in this order):
6.2 Volumes
7.1-7.5,7.7-7.8,8.1 Techniques of Integration and Arclength
9.1, 9.3 Differential Equations
10.1-10.4 Parametric Equations and Polar Coordinates
11.1-11.10 Sequences and Series

Grading:

WebAssign Homework = 10%
Tests = 60%
Final = 30%
The lowest WebAssign homework will be dropped in calculating the final homework average.
The lowest test grade will count for 5% of the final grade, with the remaining five test grades counting for 11% each.

Class Participation: I will consider class participation in computing your final grade if your grade is borderline.

In general homework will be assigned on Tuesdays and will be due the following Tuesday. Homework may be written up and handed in at the beginning of class, or typed or scanned and submitted through Canvas. The homework assignments are due at the beginning of class. I will deduct 10 percent for each day that the homework is late and I will not accept homework after Friday morning's class.

General Policies:

Attendance: Every student is expected to participate in this course through regular attendance in lecture. Students who must miss a class due to participation in any official college activity should notify me in advance. If you are ill and miss a class you are responsible for getting the notes and missed work as soon as possible. If you are ill and unable to attend an exam a makeup can be arranged only if you call my office or email me before the start of the exam, and if you get a doctor's note. Makeup exams will be more difficult than the original. Students are required to be familiar with TCNJ's attendance policy http://policies.tcnj.edu/policies/digest.php?docId=9134

Academic integrity policy: TCNJ's academic integrity policy is available at
http://policies.tcnj.edu/policies/digest.php?docId=7642
Students are responsible for being familiar with the college integrity policy. Students may work on homework assignments in groups of two or three people if they wish, however it is expected that students complete their own WebAssign homework problems independently. **Students may not discuss homework problems with a tutor before the assignment is due.**

Americans with Disabilities Act (ADA) Policy:

Any student who has a documented disability and is in need of academic accommodations should notify me and contact the Office of Disability Support Services (609-771-3199) http://differingabilities.pages.tcnj.edu
Accommodations are individualized and in accordance with section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992. TCNJ Americans with Disabilities Act (ADA) policy is available at
http://policies.tcnj.edu/policies/digest.php?docId=8082

Extra Credit: I do not give extra credit assignments, so you need to make sure that you are keeping up with the classwork as it is assigned.

Tutoring: There is a Math/Science Tutoring Center which provides free tutoring for this course. You may arrange for a regular tutor, or go to drop-in tutoring. The tutoring center is located in 101 Roscoe West, and the website with information is https://tutoringcenter.tcnj.edu/math-science/ . I will post the drop-in tutoring schedule on Canvas when it becomes available. The Department of Mathematics and Statistics also provides tutoring, and I will share that information when the schedule becomes available.

Email: I might periodically send messages to the class so you should get in the habit of checking your email at least daily. I will respond to email sent to me within 24 hours, and within 48 hours on weekends.

Cell phones: Please make sure they are turned off during class. If I observe students texting in class it will affect the final course grade.

Weather: If there is any kind of weather event, make sure to check the college webpage and your email before heading to class. At times the college may be open but I may not be able to get to campus. In this event I will send an email to the class.

Background: We will spend a good deal of this semester talking about antiderivatives. If finding derivatives is rusty, I suggest you review the following sections in Stewart's text at the beginning of the semester:
3.1 Derivatives of polynomials and exponential functions
3.2 Product Rule
3.3 Derivatives of trig functions
3.4 Chain Rule
3.6 Derivatives of Log Functions.

Make sure that you are **very** comfortable with substitution (section 5.5). I have posted an optional review assignment on substitution. You should do these problems if the topic is rusty.

If you fulfilled the prerequisite for this course by taking MAT 125, if you took Calc A more than one year ago, or if you received less than a C- in Calculus A, I would like you to see me in my office hours during the first week of the semester.