# 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.

1. **Basic information on course and instructor**
   1. 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.
   2. Course description: A second course in calculus covering integral calculus and series. The course will cover both the theoretical and applied aspects of Calculus.
   3. Course prerequisites: MAT 127: Calculus A or MAT 125 (with permission of the chair).
2. **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.

1. Learning Goals: MAT 128 will focus on an in depth understanding of:
   1. Concept of integration and its importance in geometric topics such as volumes and other applications of integration
   2. Techniques of integration
   3. Improper integrals and indeterminate forms
   4. Concept of infinite sequence including their convergence properties
   5. Concept of infinite series including their convergence properties
   6. Concept of infinite series in approximation of polynomials and their use in representing functions as power series and Taylor series
   7. Polar coordinate systems and curves defined by parametric equations
   8. Students should be able to demonstrate understanding of multiple (numerical, graphical and algebraic) representations of a calculus problem.
   9. Students should be able to justify their thought processes and solutions in clear, written form.
   10. 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.

1. 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:
   1. Utilize integration techniques to solve problems
   2. Use algebraic techniques such as partial fractions, substitutions, and integration by parts to evaluate integrals
   3. Use the concept of limits to evaluate improper integrals and indeterminate forms
   4. Determine convergence of infinite sequences and infinite series
   5. Use Taylor series for approximation purposes.
   6. Convert between rectangular and polar coordinates.
   7. Curves defined by parametric equations.
   8. Students should be able to demonstrate understanding of multiple (numerical, graphical and algebraic) representations of a calculus problem.
   9. Students should be able to justify their thought processes and solutions in clear, written form.
   10. Students should be able to solve a real-life problem involving calculus.
2. **Student assessment**
   1. 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.
   2. 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.
   3. 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.
3. **Learning activities**
   1. 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.
   2. 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.
   3. 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:*

* 1. **Integration by Parts**
  2. Trigonometric Integrals (sine and cosine cases especially)
  3. **Trigonometric Substitution**
  4. **The Method of Partial Fractions**
  5. Strategy for Integration
  6. Numerical/Approximate Integration
  7. **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**

**Instructor**: Prof. Clark

**Office**: 204 Science Complex

**Phone**: (609) 771-2019

**Email**: [kclark@tcnj.edu](mailto:kclark@tcnj.edu)

**Office Hours**: Tuesdays & Fridays 12:30-1:50 and by appointment

**Text**: Calculus Early Transcendentals, 4th Edition, by James Stewart

Section 4 meets Tuesdays & Fridays 2:00-3:20 in Room P229 Science Complex

Section 5 meets Tuesdays & Fridays 3:30-4:50 in Room P229 Science Complex

**Course Requirements:**

Quizzes + Homework = 30%

Exams = 40%

Final = 30%

**Homework**: There will be weekly homework assignments which will usually be assigned each Tuesday and will be due the following Tuesday. The homework will be posted on SOCS. These assignments will fall into three categories –

**Non hand in homework**: part of the assignment will consist of problems from the text and will not be collected. Students will be required to present some of these homework problems at the board during Tuesday’s class. You will be given advance notice when it is your turn to put homework on the board. If you are unable to attend class on the day that you are assigned to put up homework, you should notify me of the absence before the start of class. If this happens more than once it will affect your grade.

**Calculus on the Web (COW)**: You will be given weekly homework assignments to be done on two websites, one using Temple University’s Calculus on the Web, and the other using the University of Rochester’s Webwork. These problems will be “drill” problems to practice techniques learned in the class. The problems will be graded and will be a part of your homework grade in the class.

**Hand in homework**: part of the assignment will consist of problems to be graded (not taken from your text) – these will be more difficult problems than the text problems and the COW problems and should be worked on after completing the other parts of the homework. You may work on these in groups of two or three people if you wish. If you do work in a group, you should acknowledge whom you worked with on the top of your homework paper. Each member of the group should hand in a copy of the assignment, and these should be written up separately (i.e. I do not want to see homework papers that are identical).

The homework assignments are due at the beginning of class. I will deduct 10 percent for each day that the homework is late, and will not accept it more than three days late. The lowest homework score will be dropped in computing the homework average at the end of the semester.

**Quizzes**: There will be weekly quizzes, generally on Fridays. They will be about five minutes long and will be at the beginning of the class. The quiz will cover the material from the homework that was gone over the previous Tuesday. If you leave class after the quiz, the quiz will not be graded. THERE WILL BE NO MAKEUPS FOR QUIZZES. The lowest quiz score will be dropped in computing the quiz average at the end of the semester.

**Exams**: There will be two in-class exams. The first exam will occur during the 6th week of class and the second exam will occur during the 12th week of class. Exams will be more difficult than quizzes. If you are ill and unable to attend the 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.

**Final**: There will be a cumulative final exam at the end of the semester.

**Calculators**: You should have a scientific calculator (one that can handle trig functions, exponentials and logs) and may use it on homework and during class. You may not use a calculator on quizzes or exams.

**Class participation**: I will consider class participation in computing your final grade if your grade is borderline. By “class participation” I include putting homework on the board on Tuesdays.

**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 in room 145 Forcina Hall. The phone number is 771-2983. I will inform students of the drop-in schedule for this class as soon as it is available. The solutions manual for the text is kept in this tutoring lab and you are free to use it in studying. There is also a solutions manual in the math office (P231 Science Complex). You may borrow it by leaving your ID with the secretary.

**Attending other sections:** If for some reason on a specific day you need to attend the other section of the class you should okay it with me ahead of time.

**Technology:** The publisher of your text has a website with “resources for students” that you might find helpful. The URL is <http://www.brookscole/math> . Choose “student resources” from the menu on the left, then choose the icon “Single Variable Calculus” with the same picture as the cover of your text (it’s near the bottom of the page). Then choose the chapter you’re interested in from the box on the top, and then “hypercontent”. There should be resources for each section in the chapter.

**Email:** I might periodically send messages to the class so you should get in the habit of checking your email. I will respond to email sent to me as soon as possible.

**Snow:** In the event of inclement weather you should check the snow hotline 609-637-6000 or the home page for the College to see if classes have been delayed or cancelled. If classes are held but I am unable to travel in, I will email the class.

**Syllabus:**

We will cover chapters 7-11 in your text.

**Background:**

We will spend a good deal of this semester talking about antiderivatives. If finding derivatives are 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, 3.4 Derivatives of Trig functions, 3.5 Chain Rule, 3.8 Derivatives of Log Functions