Course Name & Number: MATH 2177  
Credits: 6  
Class Hours Per Week: 6  
CREDITS: 6  CLASS HOURS PER WEEK: 6  PREREQUISITES: MATH 1172 or 2153 with a C or higher

Instructor: insert your name  
Office: insert your CSCC office location  
email: insert your CSCC email address  
Phone: insert your CSCC phone number  
Instructor's Office Hours: insert your office hours, if any

COURSE DESCRIPTION
This course covers multiple integrals, line integrals, matrix theory, linear (ordinary and partial) differential equations, with applications to science and engineering.

COURSE GOALS
To introduce to the student the concepts, methods, and applications of topics in multivariable calculus, linear algebra and differential equations necessary for further study in engineering; to present key ideas and concepts from a variety of perspectives; to develop student’s mathematical thinking and problem solving ability.

INSTITUTIONAL LEARNING GOALS: For this course, students are expected to demonstrate the skills associated with the Institutional Learning Goals (ILG)
ILG #1: Critical Thinking & ILG #3: Quantitative Skills

GENERAL INSTRUCTIONAL METHODS: Instructional methods may include face-to-face or video lectures or demonstration, face-to-face or virtual discussion, individual or group activities including the use of visual aids, graphing calculators, computers and/or other technologies. Students may be expected to participate in these activities during class and/or outside of class. Instructors may require class participation, collaborative learning, and peer review.

TEXTBOOK, MANUALS, REFERENCES, AND OTHER READINGS:
Mathematical Topics for Engineers, Custom edition for CSCC, which contains
- Textbook Sections from Calculus for Scientists and Engineers: Early Transcendentals, Briggs, Cochran, Gillett and Shulz, Chapters 13-15.
- Textbook Sections from Introduction to Linear Algebra, by Johnson, Riess, and Arnold, 5th edition, Chapter 1: Matrices and Systems of Linear Equations.

SPECIAL COURSE REQUIREMENTS: None
CALCULATOR POLICIES
A graphing calculator is recommended. The Texas Instruments’ TI-84 (regular, Plus, Silver, etc.) graphing calculator is strongly recommended, fully supported, and approved for use during proctored assessments.

Calculator Alternatives: Some students may prefer to use a CASIO-FX-9750GII, TI-Nspire (non-CAS version), or a TI-83. These are less expensive options that are similar to the TI-84 and are approved for use during proctored assessments. However, your instructor will primarily use the TI-84 when teaching, meaning that you will need to learn how to perform any necessary operations using these other calculators without your instructor’s help.

Other graphing calculators may be permitted. If you own a different calculator, please check with your instructor to see if your calculator will be allowed during proctored assessments.

The TI-89, TI-92, TI-Nspire CAS, or other Computer Algebra System (CAS) are never allowed during proctored assessments.

Your instructor may require that your graphing calculator’s memory be reset (all RAM cleared) prior to each proctored assessment.

The Columbus State Bookstore sells both the TI-84 and CASIO-FX-9750GII for your convenience. Additional resources supporting the use of the TI-84 and CASIO-FX-9750GII may be available at http://www.cscc.edu/academics/departments/math/graphing-calculator.shtml.

STANDARDS AND METHODS FOR EVALUATION:
(Instructor: insert your detailed grading policy here. Follow Department Grading Policy, which can be found in Instructor Guide, to set up your grading policy.)

GRADING SCALE:
Letter grades for the course will be awarded using a 90% - 80% - 70% - 60% scale.

NOTE TO STUDENTS: To achieve a mastery of the course material, the Mathematics Department recommends that the student should be prepared to spend an average of 15 hours per week on this course.

ATTENDANCE POLICY: insert your detailed attendance policy here

MAKEUP POLICY: insert your detailed makeup policy here

LAST DAY TO WITHDRAW: If you should decide to drop this course, but do not officially do so through Records & Registration, a failing grade will be recorded on your transcript. The last day to drop this course is Thursday Oct 31, 2019. No drops will be allowed after that date. Drop forms are available from the Counseling/Advising Center and from Records and Registration.

ELECTRONIC DEVICES IN THE CLASSROOM:
• As a courtesy to your fellow classmates and instructor, please turn off your cell phone or anything else that might cause a disturbance during class.
• The use of a graphing calculator to store notes and/or formulas without the instructor’s permission is considered academic misconduct and is subject to disciplinary action according to college policy. The use of any electronic device capable of wireless communication (phone, computer, pager, etc.) is strictly prohibited during any proctored assessment (test, quiz, etc.).

TUTORING RESOURCES:
The following are ways of obtaining free tutoring:
• The Learning Resource Center (DH room 313) during the posted hours. You will be required to sign in and out using your CougarID number. Tutoring is also available at the Dublin, Westerville, and Reynoldsburg
branch locations. LRC hours at these locations change each semester. For additional information, please visit: http://www.cscc.edu/academics/departments/math/tutoring.shtml

- Peer Tutoring – sign up for Peer Tutoring in WD room 1095.
- Depending upon availability, a walk-in tutoring session may be held on Saturdays from 9am–1pm. Contact Peer Tutoring in Aquinas Hall at 287-2474 for additional information.
- Online Tutoring - You can post a question to our Math Tutoring Forum on Blackboard OR setup an appointment for a live one-on-one online tutoring session via the web. To find out more, sign into Blackboard and look for "Math Tutoring" in the "My Organizations" section.

COLLEGE SYLLABUS STATEMENTS: Columbus State Community College required College Syllabus Statements on College Policies and Student Support Services can be found at www.cscc.edu/syllabus or on the College website Quick Link “Syllabus Statement”.

LAST DAY TO WITHDRAW: If you should decide to drop this course, but do not officially do so through Records & Registration, a failing grade will be recorded on your transcript. The last day to drop this course is Thursday July 11, 2019. No drops will be allowed after that date. Drop forms are available from the Counseling/Advising Center and from Records and Registration.
COURSE TOPICS (at a glance):

PART ONE: Multivariable Integral Calculus
Textbook Sections from *Calculus for Scientists and Engineers: Early Transcendentals*, Briggs, Cochran, Gillett and Shulz, Chapters 13-15

<table>
<thead>
<tr>
<th>Text</th>
<th>Topic</th>
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<tbody>
<tr>
<td>13.8</td>
<td>Maximum/Minimum Problems</td>
</tr>
<tr>
<td>13.9</td>
<td>Lagrange Multipliers</td>
</tr>
<tr>
<td>14.1</td>
<td>Double Integrals over Rectangular Regions</td>
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<td>14.2</td>
<td>Double Integrals over General Regions</td>
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<td>14.3</td>
<td>Double Integrals in Polar Coordinates</td>
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<td>14.4</td>
<td>Triple Integrals</td>
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<td>14.5</td>
<td>Triple Integrals in Cylindrical and Spherical Coordinates</td>
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<tr>
<td>14.7</td>
<td>Change of Variables in Multiple Integrals</td>
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<tr>
<td>15.1</td>
<td>Vector Fields</td>
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<tr>
<td>15.2</td>
<td>Line Integrals</td>
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<tr>
<td>15.3</td>
<td>Conservative Vector Fields</td>
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PART TWO: Matrices and Linear Systems of Equations
Textbook Sections from *Introduction to Linear Algebra*, by Johnson, Riess, and Arnold, 5th edition, Chapter 1: Matrices and Systems of Linear Equations

<table>
<thead>
<tr>
<th>Text</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.1</td>
<td>Introduction to Matrices and Systems of Linear Equations</td>
</tr>
<tr>
<td>1.2</td>
<td>Echelon Form and Gauss-Jordan Elimination</td>
</tr>
<tr>
<td>1.3</td>
<td>Consistent Systems of Linear Equations</td>
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<tr>
<td>1.4</td>
<td>Applications (optional)</td>
</tr>
<tr>
<td>1.5</td>
<td>Matrix Operations</td>
</tr>
<tr>
<td>1.6</td>
<td>Algebraic Properties of Matrix operations</td>
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<tr>
<td>1.7</td>
<td>Linear Independence and Nonsingular Matrices</td>
</tr>
<tr>
<td>1.8</td>
<td>Data Fitting, Numerical Integration and Numerical Differentiation</td>
</tr>
</tbody>
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PART THREE: Second Order Constant Coefficient Ordinary Differential Equations
Textbook Sections from *Calculus for Scientists and Engineers: Early Transcendentals*, Briggs, Cochran, Gillett and Shulz, Chapter 16 and Appendix C

<table>
<thead>
<tr>
<th>Text</th>
<th>Topic</th>
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<tbody>
<tr>
<td>16.1</td>
<td>Basic Ideas</td>
</tr>
<tr>
<td>Appx C</td>
<td>Complex Numbers</td>
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<tr>
<td>16.2</td>
<td>Linear Homogeneous Equations</td>
</tr>
<tr>
<td>16.3</td>
<td>Linear Nonhomogeneous Equations</td>
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<tr>
<td>16.4</td>
<td>Applications</td>
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</tbody>
</table>
PART FOUR: Fourier Series & Partial Differential Equations


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<th>Text</th>
<th>Topic</th>
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<tbody>
<tr>
<td>10.1</td>
<td>Introduction: A Model for Heat Flow</td>
</tr>
<tr>
<td>10.2</td>
<td>Method of Separation of Variables</td>
</tr>
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<td>10.3</td>
<td>Fourier Series</td>
</tr>
<tr>
<td>10.4</td>
<td>Fourier Cosine and Sine Series</td>
</tr>
<tr>
<td>10.5</td>
<td>The Heat Equation</td>
</tr>
<tr>
<td>10.6</td>
<td>The Wave Equation</td>
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GENERAL INSTRUCTIONAL METHODS:
Classroom lecture, discussion, recitation, and/or problem solving explorations supplemented by visual and/or computer aids.

ASSESSMENT: *(required wording)*
Columbus State Community College is committed to assessment (measurement) of student achievement of academic outcomes. This process addresses the issues of what you need to learn in your program of study and if you are learning what you need to learn. The assessment program at Columbus State has four specific and interrelated purposes: (1) to improve student academic achievements; (2) to improve teaching strategies; (3) to document successes and identify opportunities for program improvement; (4) to provide evidence for institutional effectiveness. In class you are assessed and graded on your achievement of the outcomes for this course. You may also be required to participate in broader assessment activities.

STANDARDS AND METHODS FOR EVALUATION:
Grades will NOT be “curved”, “skewed”, or otherwise “inflated” and no retests are to be given. Three tests are recommended. The final examination should weigh between 25% and 35% of the course grade; preferably about 30%.

GRADING SCALE:
Letter grades for the course will be awarded using a 90% - 80% - 70% - 60% scale.

SPECIAL COURSE REQUIREMENTS:
None
LEARNING OUTCOMES:

Unit 1
- **Unit of Instruction:** Maxima and Minima of Functions of Several Variables
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…
  
  - Find the relative extrema and saddle points of a function of two variables.
  - Find the absolute extrema of a function over a given region.
  - Use the Second Partials Test to determine if a critical point is a relative maximum, a relative minimum, or a saddle point, or if the test is inconclusive.
  - Solve applications of extrema of functions of two variables.
  - Interpret geometrically the rationale of using Lagrange multipliers to optimize a function given a constraint.
  - Use Lagrange multipliers to optimize functions of several variables with a given constraint.
    1. Solve applications involving Lagrange multipliers

- **Assigned Reading:** 13.8 – 13.9 (Briggs)
- **Assessment Methods:** Daily questioning, graded homework assignments, quizzes and/or tests. Out of class assignments allowing for greater computational and conceptual complexity.

Unit 2
- **Unit of Instruction:** Multiple Integration
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…
  
  - Evaluate iterated integrals.
  - Evaluate double integrals over a rectangular region, and find the volume using a double integral.
  - Sketch the solid whose volume is represented by a double integral.
  - Choose an appropriate order of integration to evaluate a double integral over a region, and switch the order of integration.
  - Use a double integral to find the volume of a given solid.
  - Solve applications involving double integrals.
  - Evaluate a double integral in polar coordinates.
  - Use a double integral in polar coordinates to find the area of a region.
  - Convert from rectangular to polar coordinates to evaluate a double integral.
  - Use a double integral in polar coordinates to find the volume of a given solid.
  - Solve applications involving double integrals in polar coordinates.
  - Evaluate triple integrals.
  - Sketch the solid whose volume is given by a triple integral, and rewrite the integral in a particular order of integration.
  - Use triple integrals to find the volume of a given solid.
  - Solve applications involving triple integrals.
  - Evaluate triple integrals in both cylindrical and spherical coordinates.
  - Find the volume of a solid by a triple integral in cylindrical or spherical coordinates.
  - Convert triple integrals from rectangular coordinates to both cylindrical and spherical coordinates, and choose an appropriate one to evaluate.
  - Solve applications involving triple integrals in cylindrical and spherical coordinates.
  - Find the Jacobian for a given change of variables.
  - Sketch the resulting image of a region given a transformation.
  - Evaluate double integrals using a given change of variables.

- **Assigned Reading:** 14.1 – 14.7 (Briggs)
- **Assessment Methods:** Daily questioning, graded homework assignments, quizzes and/or tests. Out of class assignments allowing for greater computational and conceptual complexity.
Unit 3
- **Unit of Instruction:** Vector Fields and Line Integrals
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…

  - Use representative vectors to sketch a vector field
  - Verify a function is the potential function for a vector field
  - Evaluate a line integral over a given path.
  - Evaluate line integrals of vector fields over a given path.
  - Compute the work done by a force field on an object moving along a given path.
  - Solve applications involving line integrals.
  - Identify inverse square vector fields.
  - Determine whether a vector field is conservative, and if so, find its potential function.
  - Identify when a line integral is independent of path
  - Apply the Fundamental Theorem of Line Integrals to evaluate line integrals.
  - Solve applications involving the work done by a force field.

- **Assigned Reading:** 15.1 – 15.3 (Briggs)
- **Assessment Methods:** Daily questioning, graded homework assignments, quizzes and/or tests. Out of class assignments allowing for greater computational and conceptual complexity.

Unit 4
- **Unit of Instruction:** Matrices and Linear Systems of Equations
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…

  - Represent systems of linear equations in matrix form.
  - Solve systems of linear equations.
  - Demonstrate the ability to perform elementary row operations to reduce a matrix to (reduced) echelon form.
  - Employ matrix reduction techniques to solve systems of linear equations and identify inconsistent and dependent systems.
  - Recognize solution possibilities for a consistent linear system of equations
  - Perform algebraic operations with matrices
  - Compute sums, scalar products, and differences using matrices.
  - Multiply matrices, and understand associativity and noncommutativity of matrix multiplication.
  - Compute the transpose of a matrix.
  - Compute the inverse of an invertible matrix.
  - Solve systems of linear equations using the inverse of the coefficient matrix.
  - Understand the invertible matrix theorem.
  - Apply algebraic properties of matrices
  - Identify independent and dependent sets of vectors.
  - Apply matrix methods to data fitting, numerical integration and differentiation
  - Solve engineering applications.

- **Assigned Reading:** 1.1 – 1.8, 4.4 (Johnson)
- **Assessment Methods:** Daily questioning, graded homework assignments, quizzes and/or tests. Out of class assignments allowing for greater computational and conceptual complexity.
Unit 5
- **Unit of Instruction:** Second Order Linear Ordinary Differential Equations
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…

  - Perform arithmetic operations with complex numbers and convert between rectangular, trigonometric/polar and complex exponential forms
  - Write the characteristic equation of a homogeneous linear equation with constant coefficients and use it to find the general solution of the equation for all three cases: distinct roots, repeated roots, and complex roots.
  - Explain the general theory behind finding the general solutions to second order homogeneous and non-homogeneous equations.
  - Compute the Wronskian and use it to determine if a set of solutions is a fundamental set of solutions to a given homogeneous equation on a given interval.
  - Given one solution of a linear second-order differential equation, use reduction of order to find a second solution.
  - Verify that a given solution is the general solution to a non-homogeneous ODE.
  - Use the method of undetermined coefficients to solve second order non-homogeneous ODEs.
  - Use linear second-order differential equations to solve application problems such as those involving spring-mass systems and/or three component series circuits.

- **Assigned Reading:** 16.1 – 16.4, Appendix C (Briggs)
- **Assessment Methods:** Daily questioning, graded homework assignments, quizzes and/or tests. Out of class assignments allowing for greater computational and conceptual complexity.

Unit 6
- **Unit of Instruction:** Partial Differential Equations and Fourier Series
- **Student Learning Outcomes:** Upon completion of this unit the student will be able to…

  - Describe the model for heat flow at an introductory level
  - Solve two-point boundary value problems using the method of separation of variables, or show that no solution exists.
  - Determine if a given function is periodic; if it is, find its fundamental period.
  - Find the Fourier series for a given function.
  - Describe how a Fourier series seems to be converging.
  - Find the Fourier series for a given function periodically extended outside a given interval.
  - Determine whether a given function is even, odd, or neither.
  - Given a function on an interval of length L, sketch the graphs of its even and odd extensions of period 2L.
  - Find Fourier Sine and Cosine Series.
  - Use the method of separation of variables to solve the heat equation for one space variable.
  - Solve heat conduction problems with various boundary conditions.
  - Solve the wave equation and problems involving vibrations of an elastic string.

- **Assigned Reading:** Sections 10.1-10.6 (Nagle)
- **Assessment Methods:** Final exam, tests, quizzes, graded HW, individual or group projects, etc.
STUDENT CODE OF CONDUCT:  
As an enrolled student at Columbus State Community College, you have agreed to abide by the Student Code of Conduct as outlined in the Student Handbook. You should familiarize yourself with the student code. The Columbus State Community College expects you to exhibit high standards of academic integrity, respect and responsibility. Any confirmed incidence of misconduct, including plagiarism and other forms of cheating, will be treated seriously and in accordance with College Policy and Procedure 7-10.

ADA POLICY:  
It is Columbus State policy to provide reasonable accommodations to students with documented disabilities. If you would like to request such accommodations because of physical, mental or learning disability, please contact the Department of Disability Services, 101 Ebling Hall, 614.287.2570 (V/TTY). Delaware Campus students may also contact an advisor in the Student Services Center, first floor Moeller Hall, 740.203.8000 – Ask for Delaware Campus advising, or www.cscc.edu/delaware, for assistance.

WEATHER CONDITIONS  
In the event of severe weather or other emergencies which could force the college to close or to cancel classes, such information will be broadcast on radio stations and television stations. Students who reside in areas which fall under a Level III emergency should not attempt to drive to the college even if the college remains open.

Assignments due on a day the college is closed will be due the next scheduled class period. If an examination is scheduled for a day the campus is closed, the examination will be given on the next class day. If a laboratory is scheduled on the day the campus is closed, it will be made up at the next scheduled laboratory class. If necessary, laboratory make-up may be held on a Saturday. If a clinical is missed because of weather conditions: (insert department policy).

Students who miss a class because of weather-related problems with the class is held as scheduled are responsible for reading and other assignments as indicated in the syllabus. If a laboratory or examination is missed, contact me as soon as possible to determine how to make up the missed exam or lab. Remember! It is the student’s responsibility to keep up with reading and other assignments when a scheduled class does not meet, whatever the reason.

In the event the college is forced to close during Final Examination Week, exams scheduled for the first missed date will be rescheduled for (date), in the same location at the same time scheduled. Exams scheduled for a second missed date will be rescheduled for _____. Thus, our final exam is scheduled for (date) at _____ o’clock. If the college is closed that day, the exam will be held on (date) at _____ o’clock. If our exam is the second day the college has been closed, the exam will be held on (date) at _____ o’clock.

FINANCIAL AID ATTENDANCE REPORTING  
Columbus State is required by federal law to verify the enrollment of students who participate in Federal Title IV student aid programs and/or who receive educational benefits through the Department of Veteran’s Affairs. It is the responsibility of the College to identify students who do not commence attendance or who stop attendance in any course for which they are registered and paid. Non-attendance is reported quarterly by each instructor, and results in a student being administratively withdrawn from the class section. Please contact the Financial Aid Office for information regarding the impact of course withdrawals on financial aid eligibility.