MAT 203: Calculus III with Applications
Summer II 2024

Class Location and Time: Physics P112, TuTh 9:00am-1:25pm
Instructor: Nick Chakraborty (you should call me "Nick")
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Official Description: Vector algebra in two and three dimensions, multivariate differential and integral calculus, optimization, vector calculus including the theorems of Green, Gauss, and Stokes. Applications to economics, engineering, and all sciences, with emphasis on numerical and graphical solutions; use of graphing calculators or computers. May not be taken for credit in addition to AMS 261 or MAT 205.

SBC: STEM+ **Credits:** 4
Prerequisite: C or higher in MAT 127 or 132 or 142 or AMS 161 or level 9 on the mathematics placement examination

Office Hours: Mondays and Fridays 12-1 PM at the tables outside Math Tower S240A. I'll also be in the MLC on Wednesdays 12-1 PM. Check https://www.math.stonybrook.edu/cards/chakrabortynick.html for my updated hours.

Grading Scheme: Your course grade will be computed out of a total of 400 points based

- Quizzes 200 Points (50%)
- WebAssign 40 Points (10%)
- Paper Homework 60 Points (15%)
- Cumulative Final Exam 100 Points (25%)

Grade Thresholds: A 92-100 | A- 88-91 | B+ 84-87 | B 80-83 | B- 75-79 | C+ 70-74 | C 65-69 | C- 60-64 | D+ 55-59 | D 50-54 | F 0-49 . Note that I may lower these thresholds depending on student performance on exams, but I'll never raise them above the values here.

Quizzes: In lieu of midterm exams, starting the second week, there will be 4 regular quizzes administered on Tuesdays at 10:30 AM. So, expect quizzes on 7/16, 7/23, 7/30, and 8/6 – we won't do a quiz the last week of class. The quizzes will be 30 minutes long. Quizzes will be closed-book, closed-notes.

WebAssign and Paper Homework: A WebAssign subscription is required to complete the online homework in this course. Every week, a WebAssign homework and paper homework will be posted, and they are both due on Tuesdays 9 AM every week (starting the second week). Collaboration on homework is encouraged, but for the paper homework, you all have to write and turn in your own solutions. You will submit paper homework on BrightSpace. Late homework will not be accepted.

Final Exam: There will be a cumulative final exam on Thursday, August 15th at 10:30am-1pm in Physics P112 (our usual lecture room). The final will be closed-book, closed-notes.

Extra Credit: I will post worksheets of varying difficulty covering a variety of physical and mathematical applications of the material. Completing a worksheet completely correctly will earn you a certain number of extra credit points towards your quiz grade (I'll list the number of points you can earn at the top of the worksheet).

Lectures: Lectures will be hosted strictly in-person. That said, I know some of you have very long commutes to Stony Brook, so contact me if attending lectures in-person creates a problem (in which case

I'll conference you in via Zoom). Note that even if this is the case, you are still required to come in-person to take all of the quizzes and the final. I will post my notes after each lecture.

Textbook: *Multivariable Calculus*, 12th edition by Larson & Edwards. A digital copy is included in your required WebAssign subscription. You don't need a physical copy. If you want one, I encourage you to find a cheap used one from your library as there are many, and the material is standard.

Brightspace: This will be our main resource for sharing information regarding grades, announcements, and course materials so please check it regularly. Notes, practice problems, and importantly the solutions thereof will be found here.

Academic Integrity: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html.

Student Accessibility Support Center: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center (SASC), ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the staff at the Student Accessibility Support Center (SASC). For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities.

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

Tentative Plan for Term:

Week 1 (7/9 and 7/11): Review of vectors, their coordinate representations, and vector operations, including norms, dot products, and cross products. Review polar coordinates and determinants of matrices. Basic 3D geometry (lines and planes, area of parallelogram, volume of parallelepiped, and their relation to determinants). Cylindrical and spherical coordinates. Vector-valued functions and differentiation, higher derivatives. Integration of vector-valued functions.

Week 2 (7/16 and 7/18): Converting between displacement, velocity, and acceleration (and back). Centripetal acceleration. Parameterized curves in 3D, arc length parameterization, tangent and principal normal vector, binormal vector, geodesic curvature. Return to centripetal acceleration. Scalar functions of multiple variables, graphing functions of two variables. Partial derivatives and linear approximation of functions.

Week 3 (7/23 and 7/25): Multivariable chain rule, and introduce Jacobian. Gradient and its interpretation as direction of fastest increase. Higher-order partial derivatives, partial derivatives commute. The Hessian, optimization and constrained optimization problems. Gradient is perpendicular to level curves/surfaces. Tangent planes to surfaces in 3D. Vector fields: definition and examples. Divergence of a vector field and its physical interpretation. Laplacian of a scalar function.

Week 4 (7/30 and 8/1): Definition of curl, and physical interpretation (example: rotating ball). Divergence of curl is 0. Zero curl vector field is gradient of a scalar function (called a potential), under some assumptions. Line integrals of scalar functions. Line integrals of vector fields. Physical application: work. Line integral of vector field around closed curve, scalar potentials, and fundamental theorem of line integrals. Conservative vector fields and path independence. Electric and gravitational potentials.

Week 5 (8/6 and 8/8): Double integrals, and how to compute them. Changing order of integration. Volume. Double integrals in polar coordinates. Moment of inertia. Green's Theorem for line integrals around closed loops (bounding simply connected domains). Definition of surface integrals, computation of surface integrals for graph $z = f(x,y)$, and general parameterizations. Definition of flux of vector field through surface. Examples: magnetic flux, fluid flow flux.

Week 6: Tuesday (8/13): Stokes' Theorem for line integrals on closed curves. Apply to Ampere's Law for magnetic field, magnetic field of solenoid. Triple integrals: definition and examples. Cylindrical and spherical coordinates. Triple integrals in these coordinate systems. Divergence theorem for computing flux through closed surface. Surface independence.

Wednesday (8/14): Review session: 10am-12pm at the tables outside S240A.

Thursday (8/15): Final exam – 10:30am-1pm in Physics P112.