Department of Mathematics & Natural Sciences

MAT 110: Differential Calculus & Coordinate Geometry (Mathematics I)

Summer 2024

"Pure mathematics is, in its way, the poetry of logical ideas" – Albert Einstein

Consultation Schedule

Will be provided by the instructor.

Instructor's Information

Will be provided by the instructor.

Rationale

The study of this course helps to learn how things change. It provides a framework for modeling systems in which there is change, and a way to deduce the predictions of such models.

Course Aims and Outcomes

Content in this course will be adaptive, allowing students to achieve a certain concept before moving on to the next level.

Learning Outcomes

This course is designed to provide science/ engineering students an intense foundational introduction to the fundamental concepts in mathematics. After completing this course a student will be benefitted in the following ways:

- Calculate limits of single and multivariable functions both analytically and graphically.
- Comprehend the notations of differentiability and continuity for single variable functions.
- Calculate the 1st and higher order derivatives of single and multivariable functions, wherever they exist.
- Apply the single variable mean value theorem (for functions of a single variable).
- Find maxima, minima, inflection points and saddle points.
- Apply differentiation to optimization problems in both single and multivariable calculus (Lagrange Multipliers).
- Calculate Taylor Series (Single and Multivariable) and use them to find approximate values of functions.
- Calculate divergence, curl and gradient and interpret them.
- Understand and use spherical and cylindrical coordinates in three dimensions.
- Understand and apply the knowledge of conic sections to real world problems.

Course Contents:

Limits, continuity, differentiation, applications of differentiation, optimization, Taylor and Maclaurin Series, Partial derivatives, optimization of multivariable functions, gradient, curl, divergence and their applications, conic sections, polar, spherical and cylindrical coordinates.

Marks Distribution

Attendance = 5%
Assignment (best 3 out of 4) = 15%
Quiz (best 2 out of 3) = 25%
Midterm = 20%
Final = 35%
Total = 100%

Attendance	Marks
90% and above	5
85% - 89%	4
80% - 84%	3
75% - 79%	2
70% - 74%	1
Less than 70% (Unable to sit for Final Exam)	

Lecture Plan

Week 1	Introduction to Limits and Continuity
Week 2	Introduction to Differentiation and Techniques of Differentiation
Week 3	Leibnitz' product rule, Gradient, Tangent, Linear approximation
Week 4	Maxima, Minima, Optimization problems, Roll's and Mean value theorem
Week 5	Taylor and Maclaurin polynomials for single variable functions
Mid Term	
Week 6	Partial derivatives and Chain rules for partial derivatives
Week 7	Maxima and Minima of multivariable functions and Taylor expansion of multivariable functions
Week 8	Vector Calculus (Fields, Gradient, Divergence and Curl)
Week 9	Lagrange Multipliers
Week 10	Conic sections (parabola, circle, ellipse and hyperbola)
Week 11	Coordinate Geometry (polar, cylindrical, spherical coordinates and conic sections in polar coordinates)
Final	

Administrative information and Course Requirements

- There will be **no makeup quizzes**.
- For **makeup midterm**, a student must *submit application* through the corresponding chair/dean of the department within an appropriate time range.
- No students will be allowed to sit for final exam if he/she misses 30% of the total classes.
- You will find all supporting documents at [Drive link]
- You are strongly encouraged to drop by my office to ask questions and discuss problems.
- Pass mark: 50%

Reference Book:

- Calculus, Early Transcendentals (10th Edition) by **Howard Anton**
- Schum's Outlines Vector Analysis and an introduction to Tensor Analysis by **Murray R. Spiegel**
- Calculus, Early Transcendentals (9th Edition) by **Stewart, Clegg, Watson**

Academic Integrity

Each student in this course is expected to abide by the BRAC University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Also refer to plagiarism policy that will be on the web.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, a diskette, or a hard copy.

If copying occurs, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the quizzes and assigned work at home. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor May you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Attendance Requirement

Attendance in a class is mandatory.

A student with class attendance below 70% must consult the instructor in order to discuss the completion of the course.

Student absent in 3 consecutive classes will require a Chairperson's permission to attend the following classes.

Student unable to attend classes for known reason, must apply to the Chairperson, with copies to the course teacher and the Registrar's Office, mentioning the dates and reasons for absence. If it is not possible to inform it in advance, the Chairperson must be informed by sending an application through messenger, post, fax, or email.

Source: <https://www.bracu.ac.bd/academics/policies-and-procedures>