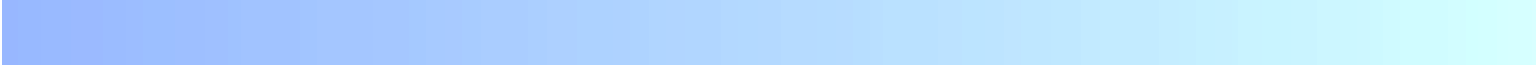
# AIUB-Logo AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

American International University-Bangladesh (AIUB)

Faculty of Science and Technology (FST) Department of Mathematics Undergraduate Program’’



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| **COURSE PLAN**   1. Course Core and Title   MAT-1102: Differential Calculus and Coordinate Geometry.   1. Credit   **3 credit hours (3 hours of theory per week)**   1. Nature   **Core Course for** CS and Engineering   1. Prerequisite   **Remedial Mathematics**   1. **Vision:**   Aimed at building up a basic foundation of  mathematical precision and tools essential for | **Spring 2021-2022**    growing engineers and also the hierarchy of  mathematical materials for engineers to continue  research in future.   1. **Mission:**   Differential calculus, vector and geometry are taught  in this course. Students embarking on such courses  diverse to different core subjects- engineering (EEE,  chemical, civil etc.), -computer science biological  (molecular and genetic) engineering-like those in UK  and USA.  Revised and constituted a course syllabus that assume  knowledge only of material that can be expected to be  familiar to all the current generation of students  starting physical science and engineering courses at  universities. |

# - Course Description:



* Function
* Differentiation
* Application of Differentiation
* Analysis of function
* Optimization problem
* Indeterminate forms and rule
* Coordinate Geometry of Two dimension
* Three-dimensional Coordinate Geometry
* Equations of lines and Planes
* Function of several variables
* Locate maxima and minima of functions of two variables

# – Course outcomes (CO) Matrix:

By the end of this course, students should be able to:

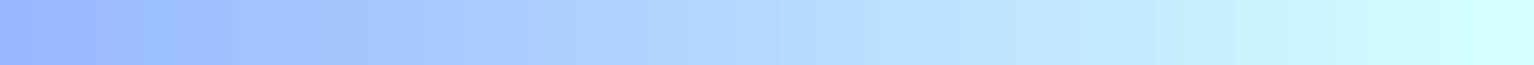
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| --- | --- | --- | --- | --- | --- | --- |
| **COs**\* | **CO Description** | Level of Domain\*\* | | | | PO  Assessed\*\*\* |
| C | P | A | S |
| CO1 | Know how to apply different techniques and various methods of differentiation. | 2 |  |  |  | 1 |
| CO2 | Identify the problems and use methods in solving optimization problems. |  | 3 |  |  | 2 |
| CO3 | Expand the use of vectors to more realistic applications. |  | 4 |  |  | 2 |
| CO4 | Analyze the problems which includes physical quantities depending on two or more variables. |  |  | 4 |  | 2 |

*C: Cognitive; P: Psychomotor; A: Affective; S: Soft-skills (CT: Critical Thinking, TS: Teamwork)*

*\* CO assessment method and rubric of COs assessment is provided in Appendix section*

*\*\* The numbers under the ‘Level of Domain’ columns represent the level of Bloom’s Taxonomy each CO corresponds to.*

*\*\*\* The numbers under the ‘PO Assessed’ column represent the PO (appendix) each CO corresponds to.*

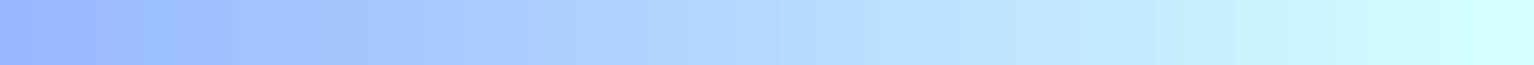


**IX – Topics to be covered in the class:**

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| --- | --- | --- | --- | --- | --- |
| **TOPICS** | **Specific Objective(s)** | **Time Frame** | **Suggested Activities** | **Teaching Strategy(s)** |  |
| **Functions**: Definition, Graph sketching, domain and range of some basic functions; Power function, Exponential and Logarithmic function, Trigonometric function, Absolute value function, Heaviside function, Floor and Ceiling function. | To introduce the basic ideas concerning functions and their graphs. | Week 1 | Lecture Discussion | Lecture notes, question- answer session. |  |
| Limit: Definition, Limit  laws, two-sided limits.  Continuity: Definition,  continuity test for  piecewise defined  function, Floor function. | To know the behavior of a function near a particular point. | Week 2 | Lecture, Discussion, Quiz1 | Lecture Notes,  Question- answer session |  |
| **Differentiation**: Derivatives and its physical interpretation, Differentiation of basic functions, product rule, quotient rule, chain rule | To acquire the knowledge of different rules of differentiation. | Week 3 | Lecture, Discussion | Lecture Notes,  Question- answer session |  |
| Implicit differentiation, Logarithmic differentiation, differentiation of inverse Trigonometric function and hyperbolic function. Equations of Tangent and Normal | To find the equation of a tangent and a normal to a curve using differentiation. | Week 4 | Lecture, Discussion, Quiz2 | Lecture Notes,  Question- answer session | **CO1** |
| Taylor and Maclaurin series, **Analysis of function**: Stationary points, increasing /decreasing function, concavity, inflection point | To represent a particular function as an infinite power series. To study the nature of a function using derivatives. | Week 5 | Lecture, Discussion | Lecture Notes,  Question- answer session |  |

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| Optimization problem, Indeterminate forms and rule | To learn how to optimize quantities. | | Week 6 | Lecture, Discussion, Quiz3 | Lecture Notes,  Question- answer session | **CO2** |
| **Midterm Exam** |  | **Week 7** | |  |  |  |
| **Coordinate Geometry of Two Dimension**: Circle, Conic Sections- Parabola, Ellipse, Hyperbola, Shifted Conics | | To identify a geometric curve represented by an algebraic equation. | Week 8 | Lecture, Discussion | Lecture Notes,  Question- answer session |  |
| Rotation of axes, Polar  Coordinates.  **Three-dimensional Coordinate Geometry**: Vectors-Dot product, Angle between two vectors, Direction angle, direction cosine, Projection, Work done | | To acquire the knowledge of basic properties of vectors. | Week 9 | Lecture, Discussion, Quiz1 | Lecture Notes,  Question- answer session |  |
| Cross product, Triple product. Application: Area, volume, coplanar | | To apply cross product for different application. | Week 10 | Lecture, Discussion | Lecture Notes,  Question- answer session |  |
| Equation of Lines and Planes, Points of intersection, Angle between planes | | To find the equations of lines and planes in three dimension using vectors. | Week 11 | Lecture, Discussion, Quiz2 | Lecture Notes,  Question- answer session | **CO3** |
| **Function of Several variables**: Partial derivatives, Higher derivatives, use derivatives to satisfy Partial Differential Equation | | To be acquainted with function with two or more independent variables. | Week 12 | Lecture, Discussion | Lecture Notes,  Question- answer session |  |
| Maximum and Minimum values: Definition, Critical Point, Second derivative test | | To study the nature of function of several variables. | Week 13 | Lecture, Discussion, Quiz3 | Lecture Notes,  Question- answer session | CO4 |
| **Final Exam** |  | **Week 14** | |  |  |  |

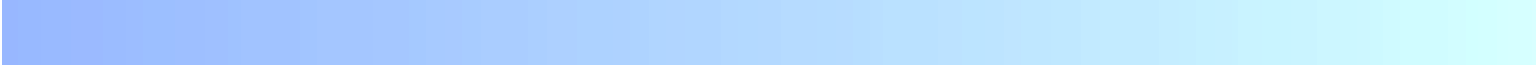
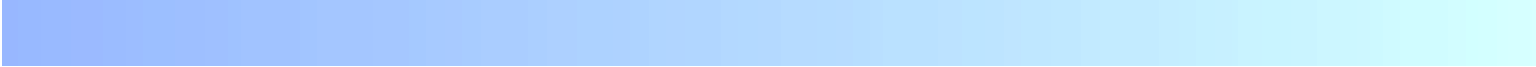
\* The faculty reserves the right to change, amend, add or delete any of the contents.



**X- Course Requirements**

At least 80% class attendance is mandatory to pass the course. All students are expected to attend all scheduled classes as well as counseling, and to read all assigned chapters/materials before coming to class. If there is any assignment given to the students, they have to submit it before the deadline decided by the course teacher.

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**XI – Evaluation & Grading System**

The following grading system will be strictly followed in this class

|  |  |
| --- | --- |
| **Marking system for Theory Classes (Midterm and Final term)** | |
| Quizzes (Best two will be counted out of three quizzes) | 40% |
| Attendance & Performance Assignment | 10%  10% |
| Midterm/Final term assessment | 20% |
| VIVA | 20% |
| **Total** | **100%** |
| **Final Grade/Grand Total** |  |
| Midterm | 40% |
| Final Term | 60% |

|  |  |  |
| --- | --- | --- |
| **Letter** | **Grade Point** | **Numerical %** |
| A+ | 4.00 | 90-100 |
| A | 3.75 | 85-89 |
| B+ | 3.50 | 80-84 |
| B | 3.25 | 75-79 |
| C+ | 3.00 | 70-74 |
| C | 2.75 | 65-69 |
| D+ | 2.50 | 60-64 |
| D | 2.25 | 50-59 |
| F | 0.00 | <50(Failed) |

The evaluation system will be strictly followed as par the AIUB grading policy.

# XII –Teaching Methods

Most of the topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Class lectures will be uploaded on the web on a regular basis. White board will be used for most of the time. Multimedia projector will be used for the convenience of the students. Students must study up to the last lecture before coming to the class and it is suggested that they should go through the relevant topics before coming to the class. Just being present in the class is not enough- students must participate in classroom discussion and classwork actively.

# – Textbook/ References

**Text Book:**

1. Calculus: Early Transcendentals- James Stewart (Eighth Edition)

**References and Study materials:**

1. Calculus- H. Anton, I.C. Bivens and S. Davis
2. Differential and Integral Calculus – F. Ayres (Schum’s Outline Series)
3. Lecture Notes



**XIV – List of Faculties Teaching the Course**

* 1. Prof. Dr. Mohammed Jashim Uddin
  2. Prof. Dr. Madhabi Islam
  3. Prof. Dr. Kh. Abdul Maleque
  4. Dr. M. Mostafizur Rahman, Associate Prof.
  5. Dr. Mahfuza Khatun, Associate Prof.
  6. Dr. Fatema Tuz Zohra, Associate Prof.
  7. Dr. Dilruba Yasmin, Assistant Prof.
  8. Tanzia Zerin Khan, Assistant prof.
  9. Prodip Kumar Ghose, Assistant prof.
  10. Ayesha Siddiqua, Assistant prof.
  11. Mortuza Ahmmed, Assistant prof.
  12. Zasmin Haque
  13. Shanta Dev

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| **Prepared by:**  **Tanzia Zerin Khan**  Date: 02/11/2021 | | **Moderated by:**  **Dr. Madhabi Islam**  Date: 02/11/2021 | |
| **Checked by:**  ....................................................  **Dr. Mohammed Jashim Uddin**  *Head*,  *Department of Mathematics*  Date:.......................................... | **Certified by:**  .........................................................  **Dr. Dip Nandi**  *Director*,  *Faculty of Science & Technology*  Date:............................................... | | **Approved by:**  .........................................................  **Mr. Mashiour Rahman**  *Associate Dean*,  *Faculty of Science & Technology*  Date:............................................... |





**XV – Verification:**

**APPENDIX**

**Program Outcomes (POs)**



|  |  |
| --- | --- |
| **PO1** | **Engineering Knowledge** |
| **1** | Apply the knowledge of mathematics, science, engineering fundamentals to the solution of complex engineering problems. |
| **PO2** | **Problem Analysis** |
| **2** | Identify, Research and Formulate complex engineering problems, Analyze and reach substantiated conclusions using the principle of mathematics, the natural sciences and the engineering sciences |

## Mapping of CO Assessment Method and Rubric

The mapping between Course Outcome(s) (COs) and The Selected Assessment method(s) and the mapping between Assessment method(s) and Evaluation Rubric(s) is shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CO** | **Description** | **Learning Domain** | **Assessment Method** | **Assessment Rubric** |
| **CO1** | Know how to apply different techniques and various methods of differentiation. | Cognitive | Quiz | Rubric for Quiz |
| **CO2** | Identify the problems and use methods in solving optimization problems. | Psychomotor | Assignment | Rubric for Assignment |
| **CO3** | Expand the use of vectors to more realistic applications. | Psychomotor | Quiz, Assignment | Rubric for  Quiz, Assignment |
| **CO4** | Solve the problems which includes physical quantities depending on two or more variables | Affective | Quiz, Assignment | Rubric for  Quiz, Assignment |

## Rubric for Midterm Exam Assessment (CO1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marking Criteria** | **Marks Distribution (Maximum 5X3=15)** | | | | **Acquired Marks** |
| **Inadequate**  **(0-2)** | **Satisfactory**  **(3)** | **Good**  **(4)** | **Excellent**  **(5)** |
| **Definition** | * Student does not answer or vaguely define the terms or concept | * Definition provided with partial relevance to the subject matter. | * Correctly define the terms. May miss minor detail. | * Correctly and comprehensive ly define the term with examples. |  |
| **Fundamental concepts of differentiation.** | * No usage of laws or incorrect usage of laws. | * Usage of laws without mentioning the name of laws. | * Usage of laws with mentioning the name of laws but with minor mistakes. | * Proper usage of laws mentioning their names correctly and without any mistake. |  |
| **Correctness of answer** | * Arrived at incorrect answer. | * Arrived at correct answer but with some logical errors. | * Arrived at correct answer with minor errors. | * Arrived at correct answer with no error. |  |
| **Acquired Marks:** | | | | |  |
| **CO Pass / Fail:** | | | | |  |

Rubric for Midterm Exam Assessment (CO2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marking Criteria** | **Marks Distribution (Maximum 5X3=15)** | | | | **Acquired Marks** |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| **Definition** | * Student does not define or vaguely define the terms or concept | * Definition provided with partial relevance to the subject matter. | * Correctly define the terms. May miss minor detail. | * Correctly and comprehensively define the terms. |  |
| **Solve problems on differentiation** | * Student does not provide correct solve   problems. | * Solved problems provided with partial relevance to the subject matter. | * Solved problems provided with minor mistakes. | * Correct reasoning provided with no mistake. |  |
| **Correctness of answer** | * Arrived at incorrect answer. | * Arrived at correct answer but with some missing steps. | * Arrived at a correct answer with minor errors. | * Arrived at correct answer showing all the relevant steps and with no error. |  |
| **Acquired Marks:** | | | | |  |
| **CO Pass / Fail:** | | | | |  |

Rubric for Final term Exam Assessment (CO3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marking Criteria** | **Marks Distribution (Maximum 5X3=15)** | | | | **Acquired Marks** |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| **Definition** | * Student does not define or vaguely define the terms or concept | * Definition provided with partial relevance to the subject matter. | * Correctly define the terms. May miss minor detail. | * Correctly and comprehensive ly define the terms. |  |
| **Usage of vectors to more realistic applications** | * Student does not choose necessary vector methods or choose totally incorrect methods. | * Student identifies the necessary methods with major errors. | * Student identifies the correct necessary methods with minor errors. | * Student correctly identifies the necessary methods without any error. |  |
| **Correctness of answer** | * Arrived at incorrect answer. | * Arrived at correct answer but with some missing steps. | * Arrived at a correct answer with minor errors. | * Arrived at correct answer showing all the relevant steps and with no   error. |  |
| **Acquired Marks:** | | | | |  |
| **CO Pass / Fail:** | | | | |  |

Rubric for Final Term Exam Assessment (CO4)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marking Criteria** | **Marks Distribution (Maximum 5X3=15)** | | | | **Acquired Marks** |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| **Definition** | * Student does not define or vaguely define the term or concept | * Definition provided with partial relevance to the subject matter. | * Correctly define the term with no example. May miss minor detail. | * Correctly and comprehensive ly define the term with example. |  |
| **Solving problems including physical quantities depending on two or more variables** | * Student does not provide reasoning or incorrect reasoning. | * Reasoning provided with partial relevance to the subject matter. | * Correct reasoning provided with minor mistakes. | * Correct reasoning provided with no mistake. |  |
| **Correctness of answer** | * Arrived at incorrect answer. | * Arrived at correct answer but with some missing steps. | * Arrived at a correct answer with minor errors. | * Arrived at correct answer showing all the relevant steps and with no   error. |  |
| **Acquired Marks:** | | | | |  |
| **CO Pass / Fail:** | | | | |  |