University of Asia Pacific (UAP)

Department of Computer Science and Engineering (CSE)

BSc in CSE Program

Course Outline

Course Name: Math III: Vector Geometry and Linear Algebra

Part A – Introduction

1. **Course No. / Course Code:** MTH 201
2. **Course Title:** Math III: Vector Geometry and Linear Algebra
3. **Course Type:** Theory
4. **Level/Term and Section:** Second year First semester
5. **Academic Session: Fall** 2024
6. **Course Instructor:** Md. Zakir Hossain
7. **Pre-requisite (If any):**
8. **Credit Value: 3.00**
9. **Contact Hours: 3.00**
10. **Total Marks: 100**
11. **Course Objectives and Course Summary:**

The objectives of this course are to:

1. Provide clear concepts of different coordinate system in 2D and 3D, curves, geometrical bodies and vectors.
2. Analyze some common problems using vector calculus and coordinate geometry.
3. Demonstrate the ability to manipulate vectors.
4. Demonstrate the Eigen values and Eigen vectors to solve real-life problem
5. Analyze Linear Algebra and transformation to apply programming and Graphics.

12. Course Learning Outcomes: at the end of the course, the student will be able to demonstrate competence with the basic ideas of vector geometry in 3D geometrical bodies and manipulate vectors, linear algebra including concepts of linear systems, independence, theory of matrices, linear transformations, basis and dimension, eigenvalues, eigenvectors and diagonalization**.**

CLOs	Statements
CLO1	**Understand** basic concepts of vector calculus
CLO2	**Solve** various problems using the basic concepts of vectors
CLO3	**Apply** multiple integrals and vector calculus to analyze common problems relating to engineering
CLO4	**Analyze** Eigen values and Eigen vectors to solve various real-life problems
CLO5	**Apply** Linear Algebra to analyze linear programming, statistics and computer graphics.

13. Mapping / Alignment of CLOs with Program Learning Outcomes (PLO) (Optional):

CLO No.	Corresponding PLOs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CLO1	PLO1	Cognitive-Understand	Lecture, multimedia	Open Book Exam, Quiz, Short Question, Written Examination
CLO2	PLO1	Cognitive-Apply	Lecture, Problem Solving	Open Book Exam, Assignment, Written Examination
CLO3	PLO1	Cognitive-Analyze	Lecture, Problem Solving	Quiz, Short Question, Written Examination
CLO4	PLO2	Cognitive- Analyze	Lecture, Problem Solving	Open Book Exam, Quiz, Short Question, Written Examination
CLO5	PLO2	Cognitive-Apply	Lecture, Problem Solving	Group Assignment, Open Book Exam, Written Examination

Part B – Content of the Course

14. Course Content:

Three dimensional geometry: Coordinates in three dimensions, direction cosines and direction ratios, planes, sphere, straight line and conicoids (basic definition and properties only) **Geometry of space:** Equations for lines, planes, cylinders and quadric surfaces, **Introduction to Vectors:** Vectors and Linear Combinations, Lengths and Dot Products. **Orthogonality:** Orthogonality of the Four Subspaces, Projections, Least Squares Approximations, Orthogonal Bases and Gram-Schmidt. **Determinants:** The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes. **Eigenvalues and Eigenvectors:** Introduction to Eigenvalues, Diagonalizing a Matrix, Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition (SVD). **Linear Transformations:** The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudoinverse. **Applications:** Matrices in Engineering, Graphs and Networks, Markov Matrices, Population, and Economics, Linear Programming, Fourier Series: Linear Algebra for Functions, Linear Algebra for Statistics and Probability, Computer Graphics."

15. Alignment of topics of the courses with CLOs:

SL. No	Topics / Content	Course Learning Outcome (CLO)
1	Three-dimensional geometry	CLO1
2	Geometry of space	CLO2
3	Introduction to vectors, orthogonality and determinants	CLO3
4	Eigenvalues and Eigenvectors	CLO4
5	Linear Transformations and Applications	CLO5

16. Class Schedule/Lesson Plan/Weekly plan:

Topics	Specific Outcome(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	Alignment with CLO

Coordinates in three dimensions, direction cosines and direction ratios.		Week 1		Multimedia or, Lecture	**CLO1**
planes, sphere, straight line and conicoids		Week 2		Multimedia or, Lecture	**CLO1**
Vectors and Linear Combinations, Lengths and Dot Products		Week 3		Multimedia or, Lecture	**CLO1**
Geometry of space: Equations for lines, planes, cylinders and quadric surfaces		Week 4		Multimedia or, Lecture	**CLO2**
Vectors and Linear Combinations, Lengths and Dot Products		Week 5		Multimedia or, Lecture	**CLO2**
MID-TERM EXAMINATION		Week 7			
Orthogonality of the Four Subspaces		Week 7		Multimedia or, Lecture	**CLO3**
Introduction to Eigenvalues, Diagonalizing a Matrix		Week 8		Multimedia or, Lecture	**CLO4**
Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices,		Week 9		Multimedia or, Lecture	**CLO4**
Singular Value Decomposition (SVD)		Week 10		Multimedia or, Lecture	**CLO5**
The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudoinverse		Week 11		Multimedia or, Lecture	**CLO3**
Matrices in Engineering, Graphs and Networks		Week 12		Multimedia or, Lecture	**CLO5**
Linear Programming, Fourier Series: Linear Algebra for Functions		Week 13		Multimedia or, Lecture	**CLO5**

Linear Algebra for Statistics and Probability, Computer Graphics		Week 14		Multimedia or, Lecture	**CLO5**
FINAL EXAMINATION		Week 15		Multimedia or, Lecture	

17. Teaching-Learning Strategies:

18. Assessment Techniques of each topic of the course:

Part C – Assessment and Evaluation

19. Assessment Strategy

Class Tests: Altogether 4 class tests may be taken during the semester,2 class tests will be taken for midterm and 2 class tests will be taken for final term. Out of these 2 class tests for each term best I class tests will be counted. No makeup class tests will be taken. Students are strongly recommended not to miss any class tests.

Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment

CIE- Continuous Internal Evaluation (30 Marks)

Bloom's Category Marks (out of 50)	**Tests (15)**	**Assignments (5)**	**Quizzes (5)**	**External Participation in Curricular/Co-Curricular Activities (5)**
Remember			**3**	
Understand	**2**		**2**	
Apply	**3**			
Analyze	**5**			
Evaluate	**5**			
Create		**5**		**5**

SMEB- Semester Mid & End Exanimation (70 Marks)

Bloom's Category	**Test**
Remember	**5**

Understand	**10**
Apply	**15**
Analyze	**15**
Evaluate	**15**
Create	**10**

20. Evaluation Policy

Grades will be calculated as per the university grading structure and individual student will be evaluated based on the following criteria with respective weights.

1. Class Tests 30%
2. Term Examination 50%
3. Mid-Term Examination 20%

UAP Grading Policy

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Part D – Learning Resources

21. Text Book:

1. A. F. M. A. Rahman and P. K. Bhattacharjee, Analytic Geometry and Vector Analysis.
2. K. Mohammad, Analytic Geometry and Vector Analysis
3. Gilbert Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press and SIAM.

Reference Books:

1. L. Seymour, Linear algebra, New Delhi: Mc-Graw Hill.
2. M. A. Rahman, Linear Algebra, Dhaka: Nahar Book.