MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Marthoma College, Kuttapuzha P.O, Tiruvalla					
Faculty/ Discipline	Mathematics					
Programme	BSc (Hons) Mathematics					
Course Coordinator	Dr. Roshan Sara Philipose					
Contributors	MANESH JACOB					
Course Name	Computational Linear Algebra					
Type of Course	DSE					
Specialization title	Computational Mathematics					
Course Code	MG6DSEMATA02					
Course Level	300					
Course Summary	This course introduces numerical and algorithmic approaches to solving linear algebra problems arising in scientific and engineering contexts. It covers techniques for solving linear systems, evaluating numerical accuracy and stability, and applying matrix factorization methods. Students will develop and implement algorithms using scientific programming languages and design computational strategies for handling high-dimensional data. Emphasis is placed on practical application and problem-solving using modern computational linear algebra tools.					
Semester	6	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

Course Outcomes (CO)

Number of COs		**6**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Analyze and apply numerical methods for solving linear systems	AN	PO1, PO2, PO3
2	Evaluate accuracy, Conditioning and numerical stability in computational problems	E	PO1, PO2, PO3, PO4
3	Use matrix factorization techniques in various situations	A	PO1, PO2, PO3, PO9
4	Prepare suitable linear algebra algorithms for specific problems using scientific programming languages.	AN	PO1, PO2, PO4, PO10
5	Design computational strategies for problems involving high dimensional matrices	E	PO1, PO2, PO10

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Number of COs		6	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
6	Apply computational Linear Algebra tools to solve problems in science and engineering	A	PO1, PO2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	-	-	-	-	-	-	-
CO 2	3	3	1	1	-	-	-	-	-	-
CO 3	3	2	2	-	-	-	-	-	1	-
CO 4	2	3	-	2	-	-	-	-	-	3
CO 5	3	3	-	-	-	-	-	-	-	1
CO 6	3	3	-	-	-	-	-	-	-	-

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Matrix Operations			
	1.1	Matrix Multiplication	4	["1"]
	1.2	Norm of vectors	4	["1"]
	1.3	Basic problems in Machine Learning and Neural Networks	7	["1"]
2	Factorization of Matrices and Applications			
	2.1	LU Decomposition and Applications	5	["2", "3"]
	2.2	QR Decomposition	5	["2", "3"]
	2.3	Gram-Schmidt Orthogonalization	5	["2", "3"]
3	Eigen Values and Factorizations			
	3.1	Diagonalization of matrices	5	["3"]
	3.2	Eigen value Algorithms	5	["4"]
	3.3	Machine Learning and Optimization Applications of eigen values and eigen vectors	5	["4"]
4	Singular Value Decomposition			
	4.1	Singular Value Decomposition of Square and Rectangular Matrices	5	["1", "5", "6"]
	4.2	Truncated Singular Value Decomposition	5	["6"]
	4.3	Basic problems in Machine Learning and Neural Networks	5	["5", "6"]

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Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Conceptual Lectures, Problem Solving, Interactive Discussions, Tutorials

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Theory **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 30 Marks** Tests, Seminar, Course Portfolio **B. End Semester Evaluation (ESE)** **• Theory – 70 Marks** Assessment Methods – Test Duration of Examination – 2.00 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ◦ PART - A ◦ Short answer - (5 out of 8) – 5 × 2 = 10 ◦ PART - B ◦ Short Essays/Problems - (5 out of 8) – 5 × 6 = 30 ◦ PART - C ◦ Essays - (3 out of 6) – 3 × 10 = 30

References

- Charu C. Aggarval : Linear Algebra and Optimization for Machine Learning, Springer 2020.
- Lloyed N. Trefethen and David Bau : Numerical Linear Algebra (III)
- Gilbert Strang: Linear Algebra and Learning from Data, Wellesley-Cambridge Press

Affidavit

- We, Marthoma College, Kuttapuzha P.O, Tiruvalla and Dr. Roshan Sara Philipose, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Marthoma College, Kuttapuzha P.O, Tiruvalla, agree to appoint a new course coordinator for the proposed Computational Mathematics in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, Marthoma College, Kuttapuzha P.O, Tiruvalla and Dr. Roshan Sara Philipose, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.

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