Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati.
(An Autonomous Institute)

Faculty of Science and Technology

Board of Studies

Basic Science and Engineering

Syllabus

Multidisciplinary Minor

Offered by General Science Department

Pattern 2023 (w.e.f. AY: 2024-25)

Multidisciplinary Minor (MDM) Subjects

AI23051	AI & Machine Learning	ET23053	Internet of Things
AI23052	Data Science	CE23051	Waste Management
AI23053	Generative AI	CE23052	Green Building & Smart Cities
CO23051	Cloud Computing	ME23051	Introduction to 3D Printing Technologies
CO23052	High Performance Computing	ME23052	Introduction to Robotics & Automation
CO23053	Computer Graphics & Gaming	EL23051	Solar Tech
IT23051	Cyber Security	EL23052	Industrial Automation
IT23052	Full Stack Development	BS23051	Nano Technology
ET23051	Embedded Systems	**BS23052**	**Linear Algebra and Statistics**
ET23052	Drone Technology		

Syllabus: Multidisciplinary Minors
Department: General Science and Engineering

Pattern 2023 (w. e. f. AY 2024-25)
Semester(III,IV,V,VI,VII)

Course Code	Course Name	Teaching Scheme			Exam Scheme						Credits		
		TH	PR	TW	ISE	ESE	Activity	TW	PR	Total	TH	PR	Total
BS23052	Linear Algebra and Statistics	2 Hr	2 Hr	-	20	50	20	20	-	110	2	1	3

Subject Co-ordinators
Mrs. G.G. Bhoite

Head of Department
Dr. A. S. Disale
Head
First Year
VPKBIET, Baramati-413133

Dean Academics
Dr. S.M. Bhosale

Principal
Dr. R. S. Bichkar
Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

BS23052: Linear Algebra and Statistics

Teaching Scheme: Theory: 2 Hours/Week Practical: 2 Hour/Week	Credits: 03 (02+01)	Examination Scheme:	
		In-Sem Exam:	20 Marks
		End-Semester Exam:	50 Marks
		Course Activity:	20 Marks
		Term Work:	20 Marks
		Total:	110 Marks

Prerequisites:
Basics of Determinants, Linear Algebra, Rank of Matrices, Set theory, Measures of central tendency.

Course Objectives: The aim of teaching this course is to learn the new concepts of linear algebra, and statistics and apply them in various fields of computer Science including data science, Machine learning, and Artificial Intelligence.

Course Outcomes (COs): The students will be able to

CO1: Acquire the knowledge of vector spaces and use it in their field.

CO2: Learn the concept of inner product spaces and the Gram-Schmidt method and apply them in various computing processes.

CO3: Learn various concepts of regression models and apply these techniques to analyze relationships among the variables.

CO4: Apply multiple linear regression analysis techniques to real-world data sets from various domains to solve real-world problems.

Course Contents

Unit 1: Vector Space [06 Hours]

Vector space, subspace, Linear combination, Spanning set, Linear Dependence & Independence of vectors, Basis & dimension of a vector space, Row space, Column Space & null space of a matrix. Linear transformation, Rank nullity theorem.

Unit 2: Inner Product Spaces [06 Hours]

Inner product spaces, Orthogonality, Orthogonal Complement, Gram-Schmidt Orthogonalization process and its applications.

Unit 3: Simple Linear Regression [06 Hours]

Simple Linear Regression Model: $Y = 0 + 1X + $, Assumptions, Estimation of the parameters $\beta 0$ and $\beta 1$ by the method of least squares, normal equations and their solution, Standard Error of estimators, Hypothesis testing for Regression Coefficient, Standard Error of prediction.

Unit 4: Multiple Linear Regression [06 Hours]

Multiple linear regression model $Y = 0 + 1X1 + \dots + \beta pXp + $, residuals, Least-Squares Estimation of the Regression Coefficients, Significance of the Least-Squares Estimators, and applications.

Text Books:
1. Matrix and Linear Algebra (aided with MATLAB), Kanti Bhushan Datta, Eastern Economic 1st Edition.
2. Introduction to Linear Algebra, Serge Lang, Springer, 2nd edition.
3. Applied Regression analysis, Draper, N. R. and Smith, H. John Wiley, Third Edition 1998.
4. Statistical Methods, S.P. Gupta, Sultan Chand and Sons, New Delhi, 10th Edition 2009.
5. Introduction to Linear Regression Analysis, Douglas Montgomery, Elizabeth A. Peck, and G. Geoffrey Vining, 5th edition, Wiley-Eastern publication.

Reference Books:
1. Linear Algebra and its Applications, David C. Lay, Pearson 3rd Edition 2006.
2. Linear Algebra and its Applications, Gilbert Strang, Cengage Learning, 4th edition.
3. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons 12th Edition 2020.
4. Linear Algebra Done Right, Sheldon Axler, Springer Fourth Edition 2024.

e-Books:

Support Vector Machines for Classification and Regression by Steve R. Gunn (https://meandmyheart.files.wordpress.com/2009/02/svm_gunn1.pdf)

Learning Resources:

https://onlinecourses.nptel.ac.in/noc24_ma11 (Applied Linear Algebra in AI and ML)
https://onlinecourses.nptel.ac.in/noc24_cs68/preview (Python for Data Science)

List of Practical (using Python)
1. Perform Matrix operations like sum, product, transpose, determinant, and Inverse.
2. Find eigenvalues and eigenvectors of matrices, Diagonalization of matrix.
3. Define row and column vectors and identify linearly dependent and independent vectors.
4. Find the dot product of vectors, the magnitude of vectors, and orthogonal vectors.
5. To fit a simple linear regression model for bivariate data.
6. Hypothesis testing for regression coefficients.
7. To fit a multiple linear regression model for multivariate data.
8. Applications of multiple linear regressions in various fields.

Guidelines for Term Work

Term work shall consist of four assignments from Unit-I to Unit-IV, and it is based on performance and continuous assessment.

Course Activity: Students have to perform any one of the following activities.

1. Seminar or PowerPoint presentation on Applications of Linear Algebra or Statistics in their field.
2. Project using Python on Applications of Mathematics in Artificial Intelligence, Machine Learning, Data Science or computing.