National Institute of Technical Teachers' Training and Research, Bhopal

PROGRAMME BRIEF

- **Title of the Program:** Mathematics for Machine Learning,
- **Program code:** ET-05
- **Programme duration: 03-07-2023 to 07-07-2023**
- **Venue: NITTTR, Bhopal**

Rationale: Machine learning (ML) and its mathematical applications are one of the most popular topics nowadays for Faculty Development Programs. This particular topic is having applications in all the areas of engineering and sciences. Various tools of machine learning are having a rich mathematical theory which is useful to develop new algorithms of machine learning, it is therefore necessary to have knowledge of all such mathematical concepts. In this course, basic mathematical concepts related to machine learning are dealt with, in particular, topics related to matrix algebra, calculus, optimization, and probability theory which are having strong linkage with machine learning. Participants of this course will have hands-on experience, especially on applications of these topics based on real-life examples.

Program Outcomes:

- Identify models of the real world, based on applications of Mathematics.
- Analyse the solution of real-world problems with suitable interpretation using open-source software.
- Use ICT and Open source courseware for teaching to problems related Mathematics for Machine learning.
- Explore the applications of Machine learning for various engineering problems.
- Use derivatives to solve application-based problems.
- Use Eigenvalue and eigenvectors problems for image compression.
- Use SVD for principal component analysis.
- Use SCILAB to solve problems based on Machine learning.
- Use Hessian Matrix and Jacobian Matrices to solve problems based on Machine learning.
- Apply Baye's Theorem to solve problems based on Machine learning.

Program Content: Vector spaces and subspaces, basis and dimensions, linear transformation, eigenvalues, and eigenvectors, Matrix Decomposition Algorithms - SVD: Properties and applications, Principal component analysis, Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobian, Hessian, Convex sets, convex functions and its properties, Unconstrained and Constrained optimization, Newton's method, Bayes' theorem.

Instructional Strategy: Following participative strategies will be employed

- Input-cum-discussion
- Individual assignments
- Presentations by participants, feedback, and validation
- Locating resources using the internet.

Target Group: Faculty members of all disciplines.

Coordinator & Faculty details: Coordinator - Dr. Deepak

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1. **Tentative Programme Schedule:**

Day	**Session 1**	**Session 2**	**Lunch**	**Session 3**	**Session 4**
	10.00 AM-11.30 AM	11.45 AM - 13.15 PM	13.30 PM - 2.00 PM	2.15 PM - 3.45 PM	4.00 PM -5.30 PM
Day-1 Monday	**Introduction to Programme** • Registration • Inauguration • Program Brief • Expectations	Use of ICT and online resources for teaching applications of Mathematics		Derivatives and their applications. Task 1: Based on input sessions	
Day-2 Tuesday	Eigenvalue and eigenvectors and their applications.	SVD for principal component analysis.		Task 2: Based on input sessions	Presentation of Task-2

Day	Session 1	Session 2	Lunch	Session 3	Session 4
	10.00 AM-11.30 AM	11.45 AM - 13.15 PM	13.30 PM - 2.00 PM	2.15 PM - 3.45 PM	4.00 PM -5.30 PM
Day-3 Wednesday	Basics of SCILAB to For applications	SCILAB for solving problems based on Machine learning		Task 3: Based on the input session	Presentation of Task-3
Day-4 Thursday	Newton Raphson method and its applications: A SCILAB Approach	Hessian Matrix and Jacobian Matrices: Applications		Task 4: Based on input sessions	Presentation of Task-4
Day-5 Friday	Baye's Theorem Applications	Preparation and presentation for the Final presentation		Plenary Session & Discussion	Achievement Test /Summarization, feedback