



SRI SATHYA SAI INSTITUTE OF HIGHER LEARNING

(Deemed to be University)

Department of Mathematics and Computer Science

CIE - I

Topics: Mathematical Review & Unconstrained Optimization

UMAM-502: Optimization Techniques for Machine Learning	Instructor: Dr. D Bhanu Prakash	Date: 08-08-2026
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Q1. Using Newton's method, find the minimizer of $f(x) = 0.5x^2 - \sin x$, $x^{(0)} = 0.5$. The required accuracy is $\epsilon = 0.1$. [Marks: 4 | BTL-4]

Q2. State and prove the second order necessary condition to find the local minima of a set constrained optimization problem [Marks: 2+4 | BTL-3]

Q3. For the vector-valued function $F(x_1, x_2) = (x_1^2 x_2, x_1 + x_2^2, \sin(x_1 x_2))$, compute the derivative (Jacobian) matrix and evaluate it at the point $(1, 0)$. [Marks: 5 | BTL-3]

Q4. For $f(x, y) = x^3 + y^3 - 3xy$, find all critical points. Using the first-order necessary condition and the second-order (Hessian) sufficient condition, classify each critical point as a local minimizer, local maximizer, or saddle point. [Marks: 5 | BTL-4]

— End of Question Paper —