



PRESIDENCY UNIVERSITY

BENGALURU

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Mid - Term Examinations - MARCH 2026

Date: 10 - 03- 2026

Time: 02:00pm - 03:30pm

School: SOCSE	Program: B.TECH		
Course Code: CAI2506	Course Name: Numerical Optimization AI		
Semester: VI	Max Marks: 50	Weightage: 25%	

CO - Levels	C01	C02	C03	C04	C05
Marks	16	32	40		

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	Explain why optimization is necessary for training machine learning models.	2 Marks	L2	C01
2	Define a saddle point in optimization.	2 Marks	L1	C01
3	Explain the role of the Hessian in Newton's Method.	2 Marks	L2	C02
4	Differentiate between constrained and unconstrained optimization problems	2 Marks	L2	C01
5	Review the statement "First-order optimality condition is necessary but not sufficient."	2 Marks	L2	C02

Part B

Answer the Questions.

Total Marks 40M

6.	a.	State the first-order and second-order optimality conditions for unconstrained optimization problems	10 Marks	L1	C02
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	b.	<p>Calculate the updated weight w_2 using NAG for the following data.</p> <p>data points: (1,2), (2,4), (3,6), (4,8)</p> <p>hypothesis: $\hat{y} = wx$</p> <p>Initial $w_0 = 1$</p> <p>Initial velocity: $v_0 = 0$</p> <p>Learning rate = 0.1</p> <p>Momentum coefficient = 0.9</p> <p>cost function: $J(W) = \frac{1}{2m} \sum_{i=1}^m (\hat{y}_i - y_i)^2$</p>	10 Marks	L3	CO3
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Or

7.	a.	Explain the mathematical tools used in optimization for AI and ML.	10 Marks	L2	CO2
	b.	Compare momentum and NAG with examples	10 Marks	L2	CO3

8.	a.	Classify optimization problems into linear vs nonlinear and convex vs non-convex problems. Give one example of each from machine learning.	10 Marks	L2	CO1
	b.	<p>Calculate the updated weight w_1 using one iteration of gradient descent for the following data.</p> <p>data points: (1,3), (2,5)</p> <p>hypothesis: $\hat{y} = wx + b$</p> <p>Learning rate = 0.1</p> <p>cost function: $J(W) = \frac{1}{2m} \sum_{i=1}^m (\hat{y}_i - y_i)^2$</p> <p>Assume initial values of weight and velocity as 0</p>	10 Marks	L3	CO3

Or

9.	a.	Explain the role of vectors, matrices, gradients, and Hessians in formulating and solving optimization problems.	10 Marks	L2	CO2
	b.	Compare momentum and NAG with examples	10 Marks	L2	CO3