



Roll No.

23/11/2023

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR

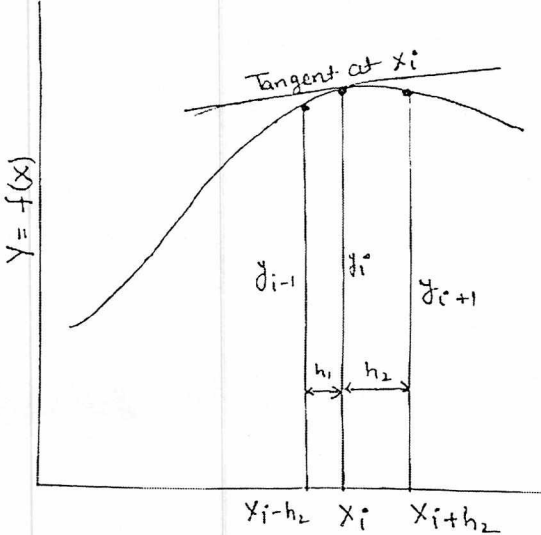
B. Tech (Chemical Engineering) - VII Semester
END-SEMESTER EXAMINATION (Nov.-Dec., 2023)CH-431 Computational Fluid Dynamics
(PE-I)

Duration: 3 Hrs.

Max. Marks: 50

Note:

- Attempt all questions
- Wherever necessary, draw neat diagram, assume data if required
- Assign proper and correct number for each answer in the answer sheet.

Sr. No.	Questions	Marks	COs
1.	<p>Derive the expression for first order derivative and second order derivative using the central difference method for non-uniform grid shown in the figure below.</p> 	10	CO1 CO2
2.	<p>Describe mathematically the following methods of solution used for initial value problem and their accuracy.</p> <ol style="list-style-type: none">Euler Method (or explicit method)Crank-Nicolson methodPure implicit method	10	CO1 CO2
3.	<p>Consider the 2D steady creeping flow of a Newtonian fluid as shown in below figure. $\Psi = 0$ (reference stream function value) is imposed on the upper wall. The problem is to be solved using the stream function-Vorticity formulation. The value of L, H/L, d/L, V and ν are specified. Formulate the problem so that velocity field can be obtained. Show clearly the discretization of governing equations and handling of boundary conditions.</p>	10	CO3

<p>4.</p>	<p>Consider the steady state heat conduction in a long square slab ($2L \times 2L$) in which heat is generated at a uniform rate q''' W/m³. The problem can be assumed two dimensional. Solve the problem using Finite difference method. Describe image point technique used for finite difference method mathematically.</p>	<p>15</p>	<p>CO5</p>
<p>5.</p>	<p>Write the steps used for Finite Volume Method.</p>	<p>05</p>	<p>CO4</p>