Total number of printed pages: 2 **PG/2th /PCEW201**

2023

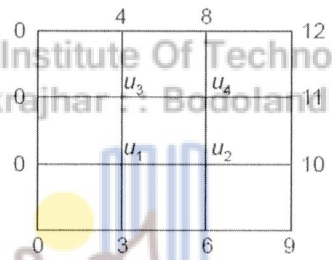
Advanced Computational Hydraulics

Full Marks: 100

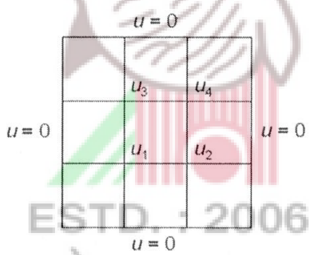
Time: 3 hours

The figures in the margin indicate full marks for the questions.

1. The function u(x,y) satisfies Laplace's equation at all points given in the figure below. Compute the solution of the interior nodes. 20



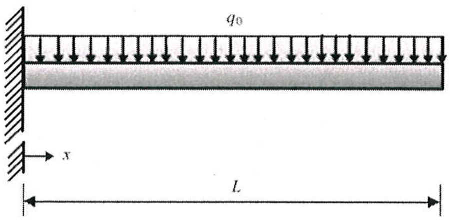
2. Solve Poisson's Equation $\partial^2u/\partial x^2 + \partial^2u/\partial y^2 = 8x2y2$ for the square grid shown below ($\Delta x = \Delta y = 1$) 20



3. Solve the boundary value problem $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$ under the conditions u(0, t)= u(π, t)=0 and u(x, 0)=sin x, $0 \le x \le \pi$, t>0, using the Schmidt method (Take h = 0.2 and α= 1/2). 20

4. Consider a uniform bar with length l. Let the bar be subjected to a Uniformly Distributed Load q_o=ax. Find the solution by Galerkin Weighted Residual Method of the governing differential equation is given by

$$AE\frac{d^2u}{dx^2} + ax = 0 \text{ with boundary conditions } u(0)=0,\ AE\frac{dy}{dx}(l) = 0 \qquad 20$$



5. Consider a simply supported beam with length l. Let the bar be subjected to a Uniformly Distributed Load q_o. Find the solution by Galerkin Weighted Residual Method of the governing differential equation is given by 20

$$EI\frac{d^4u}{dx^4} - q_o = 0 \text{ with boundary conditions } u(0)=0,\ u(l)=0,\ \frac{d^2u}{dx^2}(0) = 0, \frac{d^2u}{dx^2}(l) = 0$$