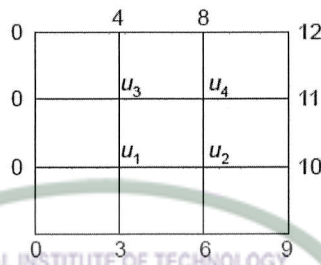**2024**
Advanced Computational Hydraulics
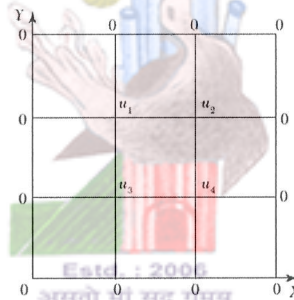*Full Marks: 100*
Time: 3 hours
The figures in the margin indicate full marks for the questions.

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 the equation $\partial^2 u/\partial x^2 + \partial^2 u/\partial y^2 = -10(x^2 + y^2 + 10)$ as shown in the figure, find the values are the interior nodes. Show at least 3 iterations. Take $\Delta x = \Delta y = 1$.   20

3. Consider a steel rod that is subjected to temperature of 125° C on the left end and 50° C on the right end. If the rod is of the length 0.1m, use finite difference method to find the temperature distribution in the rod from t = 0 sec and t = 9 sec. Use Δx= .02m and Δt=3 sec and λ=1.   20

4. Solve the following equation using a two-parameter trail solution Galerkin Residual Method

$\frac{du}{dx} + u = 0$ with boundary conditions u(0)=0   20

5. Consider a fiixed beam with length L. Let the bar be subjected to a Uniformly Distributed Load q_0. Find the solution by Galerkin Weighted Residual Method of the governing differential equation is given by   20

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