



**Attempt to answer all questions. Assume any missing data.**

The following equation describes the transport of the variable  $\phi$

$$\frac{\partial(\rho\phi)}{\partial t} + \nabla \cdot (\rho\phi\vec{U}) = \nabla \cdot (\Gamma\nabla\phi) + S_\phi$$

- 1) Simplify the equation to model a source-free one-dimensional steady diffusion in the x-direction.
- 2) Using the finite volume method, convert the model to a system of algebraic equations. Use the variables  $\phi_0$  and  $\phi_L$  to express Dirichlet boundary conditions. Illustrate your derivation with relevant sketches.
- 3) Write the system of algebraic equations for a uniform mesh consisting of 5 finite volumes. What is the type of the coefficients matrix?
- 4) Using the Jacobi-iterative method, perform two iterations towards solving the system of algebraic equations using appropriate initial guess.
- 5) Sketch the results of each iteration in a single graph.