

# Meenakshi Sundararajan Engineering College

## Department of CSE

### Innovations in Teaching

**Subject Code:** CS6801

**Subject Name:** Multi-Core Architectures and Programming

#### Parallel Programming Case studies in OpenMP/MPI

##### Simulating ocean currents

- Discretize ocean into slices represented as 2D grids
- Discretize time evolution:  $\Delta t$
- High accuracy simulation
- Static assignment: block decomposition
- Synchronization - Barriers (each grid computation is a phase) & Locks for mutual exclusion when updating shared variables (primarily for global reductions)

##### Galaxy simulation (Barnes-hut)

- Represent galaxy as a bunch of particles
- Compute forces due to gravity - Gravity has infinite extent: naive algorithm is  $O(N^2)$
- Magnitude of gravitational force falls off with distance (approximate forces from groups of far away stars)
- Result is an  $O(N \lg N)$  algorithm for computing gravitational forces between all stars

##### Ray tracing

Synthesize images of a complex scene

- Scene geometry is intersected by each ray
- Closest Intersection
- LIGHT reaches the camera from this surface p