Monday 8.1 (2 hrs)
Introduction to reservoir simulation; need for numerical solutions; discretization of the simple, linear diffusivity equation derivation; concept of grid blocks; Taylor series: forward, backward and central differences; error terms; time and space derivatives; discretization of the simple form of the partial difference equation into a difference equation; explicit and implicit formulations, stability

Hand-out note 1: Introduction to reservoir simulation
Exercise 1: Numerical solution of the linear diffusivity equation

Thursday 11.1 (2 hrs)
Implicit and explicit formulations of the difference equations; stability of solution; solution of linear equations; Formulation of boundary conditions for the difference equations; constant pressure boundary (Dirichlet condition) and constant rate boundary (Neuman condition); Derivation of partial differential equation (PDE) for one-dimensional, one-phase flow: 1) mass balance, 2) Darcy's eqn., 3) eqn. of state of fluid (B-factor or compressibility definitions) 4) pore compressibility. Diffusivity equation. Definition of transmissibilities and storage coefficients.

Hand-out note 2: Review of basic steps in derivation of flow equations
Hand-out note 3: Discretization of the flow equations
Hand-out note 4: One dimensional, single phase simulation
Hand-out note 5: Direct solution of linear sets of equations

Monday 15.1 (2 hrs)
Discretization of flow equations (cont'd); variable grid sizes; transmissibilities and storage coefficients. treatment of wells, injection and production well conditions. Multiphase flow; derivation of oil-water flow equations; continuity; Darcy´s, phase behavior; rock compressibility; review of relative permeabilities and capillary pressures; Well conditions.

Hand-out note 6: Oil-water simulation - IMPES solution

Thursday 18.1 (2 hrs)
Multiphase flow (cont'd); discretization of flow equations for two phase flow (O-W); oil and water transmissibilities and storage terms; review of relative permeabilities and capillary pressures. selection of mobility term for oil-water flow; upstream, downstream and average selection; physical arguments for selection; effects on simulation results; discussion of solution methods; introduction to IMPES method; basic assumptions for IMPES method; solution of pressures and saturation using IMPES method; illustration of numerical errors using the Buckley-Leverett system.

Exercise 2: Oil-water simulations

Monday 22.1 (2 hrs)
Two-phase, oil-gas simulation; definitions; review of parameters and functional dependencies; equations for saturated systems; equations for undersaturated systems; Solution of non-linear equations using IMPES method; Newtonian iteration

Hand-out note 7: Saturated oil-gas simulation - IMPES solution
Hand-out note 8: Underaturated oil-gas simulation - IMPES solution

Thursday 25.1 (2 hrs)
Two-phase, oil-gas simulation (cont´d); review of parameters and functional dependencies;; equations for undersaturated systems; Solution of non-linear equations using IMPES method;

Monday 29.1.2 (2 hrs)
Three-phase, oil-gas-water simulation; definitions; review of parameters and functional dependencies; equations for saturated systems; equations for undersaturated systems; Solution of saturated equations using IMPES method

Hand-out note 9: Three Phase Flow
Hand-out note 10: Variable Bubble Point Problems

Thursday 1.2 (2 hrs)
Three-phase equations (cont´d), equations for undersaturated systems; Solution of saturated equations using IMPES method; summing up; Solution of non-linear equations using Newtonian iterations.

Hand-out note 12: Solution of non-linear equations

Monday 5.2 (2 hrs) lecturer Carl Fredrik Berg
Eclipse model, short course

Exercise 3: Introductory Eclipse exercise

Thursday 8.2 (2 hrs) lecturer Carl Fredrik Berg
Eclipse model, short course

Exercise 4: Continued Eclipse exercise 3 (refined grid)
Exercise 5: Continued Eclipse exercise 3 (horizontal wells)
Exercise 6: Eclipse exercise 6 (water and gas coning)

Monday 12.2 (2 hrs)
Cylindrical coordinates, transformation of coordinates before discretization; Introduction to fractured reservoir simulation; Description of dual porosity systems; Ekofisk description; Equations for modelling fluid flow in naturally fractured reservoirs (Ekofisk type); equations for transport in fractures and supply from matrix blocks; dual porosity, single permeability formulation (2ϕ−1K); dual porosity, dual permeability formulation (2ϕ−2K)

Hand-out note 11: Systems of variable flow area

Hand-out note 13: Introduction to Fractured Reservoir Simulation

Thursday 15.2 (2 hrs)
Introduction to compositional simulation; *Compositional* fluid formulation vs. *Black Oil* fluid formulation; short presentation of flow equations for compositional reservoir simulation; n-component model; *Compositional* fluid formulation; pseudocompositional model; Derivation of *Black Oil* equations from *Compositional* equations; definitions of components, mass fractions and equilibrium constants for this special case;

Hand-out note 14: Introduction to compositional simulation

Monday 19.2 (2 hrs) lecturer Per Arne Slotte
Construction of reservoir models, data types needed, real reservoir complexities, example field models, history matching

Thursday 22.2 (2 hrs) lecturer Per Arne Slotte
Construction of reservoir models, data types needed, real reservoir complexities, example field models, history matching

Monday 26.3 (2 hrs)
Construction of reservoir models, cont´d: lecturer Per Arne Slotte
Introduction to the group project, groups

Group Work: Norne project description

Thursday 1.3 (2 hrs)
Questions related to the Norne project, Carl Fredric Berg

Monday 26.3
No lecture, group work

Thursday 1.4
Status meeting in P2 for Norne project; Carl Fredric Berg

Monday 5.4
No lecture, group work

Thursday 8.4
Status meeting in P13 for Norne project

Monday 12.4
No lecture, group work

Thursday 15.4
Status meeting in P13 for Norne project

Monday 19.3
No lecture, group work

Thursday 22.3
Status meeting in P13 for Norne project

Monday 26.3
No lecture, Easter week

Thursday 29.3
No lecture, Easter week

Monday 29.3
No lecture, Easter week

Thursday 1.4
Status meeting in P13 for Norne project

Monday 2.4
No lecture, group work

Thursday 5.4
Status meeting in P13 for Norne project

Monday 9.4
No lecture, group work

Thursday 12.4
Status meeting in P13 for Norne project

Monday 16.4
No lecture, group work

Thursday 19.4

Status meeting in P13 for Norne project
Monday 23.4
Final presentations in P13 for Norne project