ASTRO 509: Stellar Dynamics

The text is Binney and Tremaine's Galactic Dynamics (2nd edition).
Lecture notes will be available from
`http://hpcc.astro.washington.edu/faculty/trq/astr509.pdf`

Outline

1. Orbits of Stars and Planets, BT ch. 3

   Newton's equations of motion and conserved quantities. Numerical methods. The Structure of Orbits in Phase Space. Hamiltonian dynamics, Canonical transformations, Action-angle variables, Hamilton-Jacobi Eqn. Orbits in a Kepler potential: Delauney variables, Canonical perturbation theory, pendulum equations. Symplectic Maps. Orbits in galactic potentials.

2. Potential Theory, BT ch. 2

   Poisson's Equation, Spherical Systems, Flattened Systems, Techniques for solving Poisson's equation.

3. Equilibrium of Collisionless Stellar Systems, BT ch. 4

   The Collisionless Boltzmann Equation, Liouville's Theorem. Moment Equations: Jeans Equations (Oort Limit and Asymmetric drift) Virial Equations. Jeans theorems. Solutions to the CBE and Poisson Eqns: Spherical and Axisymmetric. N-body models, other numerical methods. Choice of equilibrium.

4. Stability of Stellar Systems, BT ch. 5

   Perturbation Theory, Jeans Instability, stability of uniformly rotating systems. Radial orbit instability, instabilities in barred potentials. Instabilities and galaxy formation.

5. Spiral Structure, BT ch. 6

   The winding problem, Density Wave Theory, Swing amplification.

6. Collisions and Encounters between Stellar Stellar Systems, BT ch. 8

   Dynamical friction, Tidal Shocks, Tidal Radii.

Evaluation

1. Problem Sets: 70%
2. Final: 30%
   Monday, March 16, 2015, 230-420 pm, PAB B356A