Syllabus for Ordinary Differential Equations Preliminary Exam
(Based on Math 677: Ordinary Differential Equations)

Linear Systems:

Exponentials of operators, diagonalization, fundamental theorem, planar linear systems, complex and multiple eigenvalues, Jordan forms, stability theory, nonhomogeneous linear systems
[Perko, Chapter 1, Sections 1.1-1.10]

Nonlinear Systems, Local Theory:

Fundamental existence and uniqueness theorem, dependence on initial conditions and parameters, maximal interval of existence, flows, linearization, stable and unstable manifolds, Hartman-Grobman theorem, stability and Lyapunov functions, classification of equilibrium points, center manifolds, gradient and Hamiltonian systems, bifurcations at nonhyperbolic equilibrium points
[Perko, Chapter 2, Sections 2.1-2.10 and 2.12, 2.14, as well as Chapter 4, Section 4.2]

Nonlinear Systems, Global Theory:

Dynamical systems, global existence theorems, limit sets, attractors, periodic orbits, limit cycles, Poincare-Bendixson theory
[Perko, Chapter 3, Sections 3.1-3.3, 3.7]

The material is taken from the following book:

Lawrence Perko: Differential Equations and Dynamical Systems, third edition, Springer-Verlag, 2001.