Materials to be covered in the final exam

1.1 and 1.2	concepts: ordinary vs partial differential equations, linear vs nonlinear, the order, initial value problem, explicit solutions, implicit solution, existence and uniqueness;
2.1 and 2.2	separable equations
2.3	linear equations, homogeneous vs nonhomogeneous equations
2.4	exact equations, test for exact equations, how to find solutions
2.5	integrating factors, definition, and some special integrating factors
2.6	substitutions and transformations: homogeneous equations, special form $y'=G(ax+by)$, Bernoulli equations;
3.2	some applications: compartmental analysis, population models
4.1	mass-spring oscillator
4.2	homogeneous linear equations, linear dependence, Wronskian
4.3	complex roots
4.4	nonhomogeneous equations, the method of underdetermined coefficients
4.5	superposition principle
4.6	variation of parameters (variation of constant)
4.7	Cauchy-Euler Equation; method of reduction
4.8	Energy integral lemma for $y''=f(y)$
4.9	Mechanical Vibration
7.1-7.2	Laplace transforms, definition, properties and calculations
7.3	Further properties of Laplace transforms: translation, Laplace transforms of derivatives, derivatives of Laplace transforms
7.4	Inverse Laplace transforms
7.5	Using Laplace transforms to solve IVPs
7.6	Laplace transforms of discontinuous functions, unit step function, window function, translation in t
7.7	transform of periodic functions
7.8	Convolution theorem: proof and applications of the convolution theorem
7.9	Impulse and Dirac delta function
8.1-8.2	Taylor polynomial and series, power series and analytic functions, ration test for convergence of power series, shifting the summation index
8.3-8.4	Power series solutions at a singular point
8.5	Cauchy-Euler equation (also section 4.7)
8.6	Classification of singular points, indicial equations, method of Frobenius
8.8	Special functions and their indicial equations: hypergeometric equation, Bessel's equation; Legendre's equation