1. Know the following definitions and theorems:

- **a**. order of a differential equation,
- **b**. linear differential equation
- **c**. homogeneous, non-homogeneous, autonomous
- **d**. existence uniqueness theorem for first order differential equations,
- **e**. exact and separable first order equations,
- **f**. phase line for an autonomous first order differential equation
- **g**. Wronskian, linearly independent functions on an interval,
- **h**. characteristic equation of a second order linear constant coefficient differential equation,
- **i**. phase plane for a system of two first order autonomous differential equations in two unknown functions,
- **j**. definition of linearity for a system of differential equations,
- **k**. eigenvalues and eigenvectors,
- **l**. linearly independent vectors,
- **m**. linearly independent set of vector valued functions on an interval $\left[a, b\right]$,
- **n**. Wronskian of a set of vector valued functions,
- **o**. fundamental solution set,
- **p**. existence-uniqueness theorem for a first order system of differential equations,
- **q**. equilibrium points,
- **r**. Laplace transform,
- **s**. convolution of two functions,
- **t**. convolution theorem,
- **u**. properties of the Dirac delta function,
- **v**. singular and regular singular points of a second order differential equation.

2. You should be able to do the following:

- **a**. solve mixing problems and population growth problems,
- **b**. find exact solutions to first order linear and separable differential equations,
- **c**. find exact solutions to second order linear constant coefficient differential equations,
- **d**. know how to solve Cauchy-Euler second order differential equations,
- **e**. reduction of order technique, which is used to find a second solution to a DE,
- **f**. variation of parameters, which is used to find a particular solution to a non-homogeneous DE,
- **g**. sketch a few lines in a phase plane,
- **h**. find eigenvalues and eigenvectors of 2×2 matrices,
- **i**. construct a fundamental solution set for linear constant coefficient systems of differential equations, and the general solution to such a system,
- **j**. solve an initial value problem for a constant coefficient first order system,
- **k**. be able to use the Laplace transform to convert a differential equation into an algebraic equation,
- **l**. use the table of Laplace transforms to compute the inverse Laplace transform of a function,
- **m**. use the definition of Laplace transform to verify any of the formulas in the table of transforms,
- **n**. compute the convolution of two functions,
- **o**. use the delta function to model an impulse force,
- **p**. find power series solution of a second order differential equation around an ordinary point.
- **q**. find a power series solution of a second order differential equation around a regular singular point using the method of Frobenius.