

MTH 225 DIFFERENTIAL EQUATIONS – Course objectives

A comprehensive final exam testing the degree of mastery of the following course objectives is required.

1. Solution of first order differential equations using the following techniques:
 - 1.1 Separation of Variables
 - 1.2 Homogeneous Equations
 - 1.3 Exact
 - 1.4 Linear
 - 1.5 Bernoulli

2. Applications of differential equations
 - 2.1 Linear
 - a. Growth and Decay
 - b. Cooling
 - c. Finance
 - d. Chemical Mixture
 - e. Orthogonal trajectories (rectangular and polar)
 - f. Circuits
 - g. Others (time permitting)
 - 2.2 Non-linear
 - a. Logistic
 - b. Chemical mixture
 - c. Vibrating mass (simple harmonic, damped and forced motion)

3. Solution of higher order linear differential equations, real coefficient
 - 3.1 Homogeneous equation
 - 3.2 Nonhomogeneous equation
 - a. Undetermined coefficients (using differential operator)
 - b. Variation of parameters (order 2 and then order n)

4. Solution of higher order linear differential equations, variable coefficient
 - 4.1 Equidimensional (Cauchy-Euler) equation
 - 4.2 Power series solution around an ordinary point
 - 4.3 Solutions about a regular singular point (Frobenius – Case 1)

5. LaPlace Transform
 - 5.1 Definition
 - 5.2 Transform of $\{1, t^n, e^{at}, \sin kt, \cos kt, \sinh kt, \cosh kt\}$
 - 5.3 Inverse Transforms
 - 5.4 Properties-translation, derivative of transform, transform of derivatives and of integrals and convolution
 - 5.5 Solution of initial value linear differential equations
 - 5.6 Solution of a system of linear differential equations-order two

6. Systems of Linear Differential Equations
 - 6.1 Introduction and Basic Definitions
 - 6.2 Operator Method for Systems
 - 6.3 Homogeneous Linear Systems
 - a. Real distinct eigenvalues
 - b. Repeated eigenvalues
 - c. Complex eigenvalues