MATH 265 – DIFFERENTIAL EQUATIONS

1. Course Description:

- This course introduces the theory and applications of ordinary differential equations of first and higher (mostly second) order as well as systems of linear differential equations. It includes both quantitative and qualitative methods. The course deals with theoretical aspects of existence and uniqueness of solutions as well as techniques for finding these solutions: analytical, numerical, power-series.

2. Topics Covered

- **First-order ordinary differential equations (DEs)**
  - Classification of DEs; initial value problem
  - Existence and uniqueness of initial value problem solutions
  - Separable Des
  - Homogenous Des
  - Linear DEs and integrating factors
  - Exact DEs and the method of integrating factors
  - Numerical approximations: Euler's method.
- **Applications of first-order differential equations**
  - Motion problems
  - Mixing problems
  - Exponential growth
  - Logistic equations.
- **Second-order linear DEs**
  - Homogenous linear DEs with constant coefficients
  - Fundamental solutions, independence, Wronskian
  - Complex and repeated eigenvalues
  - Non-homogenous linear DEs; the method of undetermined coefficients
  - The method of variation of parameters
  - Cauchy-Euler Des
  - Higher-order linear DEs; the method of reduction of order
  - Applications of higher-order DEs such as the harmonic oscillator and circuits
  - Power series method of solving the second-order linear DEs.
- **Laplace transform**
  - Definition of Laplace transform
  - Solution of an initial value problem using Laplace transform
  - Step functions
  - Differential equations with discontinuous forcing functions
  - Impulse functions
  - Convolution integral
- **Systems of first-order linear equations**
  - Matrices and linear algebraic equations
  - Eigenvalues and eigenvectors
  - Homogeneous linear systems with constant coefficients
  - Complex eigenvalues
  - Fundamental matrices; repeated eigenvalues
  - Nonhomogeneous linear systems.
  - Qualitative analysis of systems of DEs: the Phase plane.
- **Using graphing technology to analyze topics**
  - Graphical manner
  - Numerical manner

- Tabular manner.

3. **What to expect?**
   - **Time: The most common term lengths are listed below; others would be proportionate. Outside of class time is studying, completing homework, reviewing, etc.**

Length of term	In-class time	Out-of-class time (typical)	Total hours/wk (typical)	Total Term hours (typical)
17 weeks	4 hrs/wk	8 hrs/wk	12	204
6 weeks	11.3 hrs/wk	22.7 hrs/wk	34	204

   - Technology: Graphing technology is used.
   - Grading: Students who earn a grade of C or higher in Math 265 will pass this course.
4. **Who should enroll**?
   - This course is strongly recommended for students in STEM majors who have completed Math 155 (Calculus II) with a grade of C or better.
5. **What prior knowledge students need to know to be successful?**

- Differentiation
- Optimization
- Integration
- Parametric Equations
- Vectors
- Power Series
- Complex Numbers