A. **TITLE**: Differential Equations

B. **COURSE NUMBER**: MATH 364

C. **CREDIT HOURS**: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

- # Credit Hours: 4
- # Lecture Hours: 4 per week
- # Lab Hours: per week
- Other: per week

Course Length: 15 Weeks

D. **WRITING INTENSIVE COURSE**: N/A

E. **GER CATEGORY**: 1

F. **SEMESTER(S) OFFERED**: Spring and fall semesters

G. **COURSE DESCRIPTION**: A course in Ordinary Differential Equations. Topics include: First-order differential equations, higher-order differential equations with constant and variable coefficients, applications of first and second-order linear equations, Laplace transforms, systems of linear differential equations and numerical methods for ordinary differential equations (optional).

H. **PRE-REQUISITES/CO-REQUISITES**:

- a. Pre-requisite(s): Calculus II (MATH 162) with a grade of C or better or permission of instructor.
- b. Co-requisite(s): N/A
- c. Pre- or co-requisite(s): N/A

I. **STUDENT LEARNING OUTCOMES**:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>PSLO</th>
<th>GER</th>
<th>ISLO</th>
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<tbody>
<tr>
<td>b. Solve first-order ODE’s and IVP’s using separation of variables, integrating factors, substitutions, or numerical analysis</td>
<td>N/A</td>
<td>1</td>
<td>3. Quantitative Lit./Reasoning [QTR]</td>
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<td>c. Find the general solution of second-order ODE or higher order homogeneous or nonhomogeneous ODE’s</td>
<td>N/A</td>
<td>1</td>
<td>3. Quantitative Lit./Reasoning [QTR]</td>
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<td>d. Solve ODE’s using the Laplace transform</td>
<td>N/A</td>
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<td>3. Quantitative Lit./Reasoning [QTR]</td>
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<td>e. Solve systems of ODE’s</td>
<td>N/A</td>
<td>1</td>
<td>3. Quantitative Lit./Reasoning [QTR]</td>
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<td>KEY</td>
<td>Institutional Student Learning Outcomes [ISLO 1 – 5]</td>
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<td>ISLO #</td>
<td>ISLO &amp; Subsets</td>
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<td>1</td>
<td>Communication Skills</td>
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<td>Oral [O], Written [W]</td>
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<td>Critical Thinking</td>
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<td>Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
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<td>Foundational Skills</td>
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<td>Information Management [IM], Quantitative Lit./Reasoning [QTR]</td>
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<td>4</td>
<td>Social Responsibility</td>
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<td>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</td>
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<td>5</td>
<td>Industry, Professional, Discipline Specific Knowledge and Skills</td>
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J. **APPLIED LEARNING COMPONENT:** Yes______ No___x____

K. % **TEXTS:** Ordinary Differentil Equations from Calculus to Dynamical Systems, V.W. Noonburg, Mathematical Association of America (Incorporated), 2014

L. % **REFERENCES:** N/A

M. % **EQUIPMENT:** N/A

N. % **GRADING METHOD:** A-F

O. % **SUGGESTED MEASUREMENT CRITERIA/METHODS:** Instructors may use a combination of:
- Exams
- Assignments
- Participation

P. **DETAILED COURSE OUTLINE:**

I. Introduction to ordinary differential equations (ODE’s)
   A. Multivariable functions and partial derivatives
   B. Classification of ODE’s
   C. Verification of solutions
   D. Explicit and implicit solutions
   E. Initial value problems

II. First Order ODE’s
   A. Separable variables
   B. Linear equations
   C. Exact equations
   D. Homogeneous ODE
   E. Bernoulli Equations
   F. Other miscellaneous substitutions (optional)
   G. Geometric characterization of solutions (direction fields)
   H. Numeric methods (Euler’s method)
I. Applications of first order ODE

III. Second order ODE’s
   A. Vectors in the plane
   B. Vectors in 3-space
   C. Linear dependence and independence
   D. Using the Wronskian
   E. Finding a second solution using reduction of order
   F. Homogeneous Second order linear ODE with constant coefficients
   G. Nonhomogeneous Second order linear ODE
      a. Method of undetermined coefficients
      b. Variation of parameter
   H. Solutions by power series (optional)
   I. Applications of second order ODE’s

IV. Higher order ODE’s (Optional)
   A. Use determinant to determine linear independence or dependence
   B. Solutions of higher order linear ODE
   C. Higher order linear ODE with constant coefficients
      a. Method of undetermined coefficients
      b. Variation of parameters
   D. Euler equations
   E. Solve ODE by power series
      a. Series solutions about ordinary points
      b. Series solutions about singular points

V. The Laplace Transform
   A. Laplace transform
   B. Inverse transform
   C. Translation theorems and the unit step function
   D. Transforms of derivatives, integrals, piecewise, and periodic functions
   E. Solutions of differential equations using the Laplace transform
   F. The convolution of two functions and the transform of a convolution (optional)

VI. Systems of Differential Equations
   A. Solutions of homogeneous linear systems using Eigenvalues and eigenvectors

Q. LABORATORY OUTLINE: N/A