

Differential Equations and Linear Algebra TCSU MATH 260

A. Description

First course in differential equations and linear algebra.

B. Recommended Preparation

Three semesters of calculus for science, mathematics, and engineering.

C. Prerequisites

Multivariable Calculus

D. Minimum Unit Requirement

4 semester units

E. Course Topics

1. Classification of differential equations as linear, nonlinear, ordinary, partial, first order, second order, constant coefficient
2. First order differential equations and slope fields
3. Qualitative behavior of solutions without explicit solving the equation
4. Existence and uniqueness of solutions of first order equations
5. Separable first order equations and their solutions
6. Linear first order equations and their solutions
7. Euler's method for approximating solutions
8. Applications of first order equations such as the logistic equation, bodies moving in a resistant medium, mixing problems
9. Linear differential equations of higher order
10. Nature of the solution space
11. Homogeneous equations with constant coefficients and their solutions
12. Method of undetermined coefficients
13. Unforced harmonic oscillator, undamped, under-damped, critically damped, over-damped
14. Forced harmonic oscillator, damped and undamped
15. Resonance
16. Cauchy-Euler equation (second order, homogeneous)
17. Vector spaces
18. Lines and planes in 3-space
19. Vector spaces of functions
20. Matrix algebra
21. Systems of linear algebraic equations in matrix form
22. Nature of the solution space
23. Gaussian elimination and row echelon form
24. Rank of a matrix

25. Column space and row space of a matrix
26. Determinants
27. Eigenvalues
28. Diagonalization
29. Systems of linear differential equations in matrix form
30. Solution by diagonalization including complex eigenvalues
31. Matrix exponential

F. Student Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Solve first order differential equations;
2. Solve applications of first order differential equations in the sciences;
3. Solve higher order linear differential equations;
4. Solve homogeneous differential equations with constant coefficients; and
5. Solve systems of differential equations.