

## COURSE TITLE:

### SPECIAL TOPICS IN DIFFERENTIAL AND DIFFERENCE EQUATIONS

#### INSTRUCTORS:

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Professor Christos J. Schinas

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#### SYLLABUS:

The wave equation in two dimensions. The overlapping principle. The heat equation in three dimensions. Bessel functions. Spherical harmonic coordinates. Legendre polynomials. The Laplace equation in three dimensions. Linear vector spaces. Inner product. Linear subspaces. Orthonormalization. Linear operators. Adjoin operators.

Basic theory of difference equations, Linear difference equations of first order, Linear homogenous difference equations with constant coefficients, Linear non-homogenous difference equations: Method of undetermined coefficients, The method of variation of constants, Systems of difference equations, Fixed points (Equilibrium points) of a difference equation of first order: Hyperbolic fixed points, Nonhyperbolic fixed points, Stability of a hyperbolic fixed point, Stability of a nonhyperbolic fixed point, Stability of linear systems, Stability of difference equations of second order: Stability of a hyperbolic fixed point via linearization, Central manifolds, Stability of a nonhyperbolic fixed point via the central manifold, Attractivity of fixed points, Applications of difference equations in Population Dynamics, Biomathematics.

#### BIBLIOGRAPHY:

1. R. P. Agarwal, *Difference equations and inequalities*, Marcel Dekker, New York, 1992.
2. E. Camouzis and G. Ladas, *Dynamics of Third-Order Rational Difference Equations with Open Problems and Conjectures*, Chapman & Hall/CRC, Boca Raton, London, 2008.
3. L. Edelstein-Keshet, *Mathematical Models in Biology*, Birkhauser Mathematical Series, New York, 1988.
4. S. Elaydi, *An introduction to Difference Equations*, Springer-Verlag, New York, 1996.
5. S. Elaydi, *Discrete Chaos with applications in science and engineering*, Chapman & Hall/CRC, 2008.
6. E. A. Grove, and G. Ladas, *Periodicities in Nonlinear Difference Equations*, Chapman & Hall/CRC, 2005.
7. V. L. Kocic and G. Ladas, *Global behavior of nonlinear difference equations of higher order with applications*, Kluwer Academic Publishers, Dordrecht, 1993.
8. M. R. S. Kulenovic and G. Ladas, *Dynamics of Second Order Rational Difference Equations*, Chapman & Hall/CRC, 2002.
9. L. C. Andrews, *Elementary Partial Differential Equations with Boundary Value Problems*, Academic Press Inc..
10. H. Sagan, *Boundary Eigenvalue Problems in Mathematical Physics*, Dover Publications, Inc..
11. I. N. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill Kogakusha, Ltd..
12. Ν. Μυλωνάς και Χρ. Σχοινάς, *Διαφορικές Εξισώσεις, Μετασχηματισμοί & Μιγαδικές Συναρτήσεις*, Εκδόσεις Τζιόλα, Θεσσαλονίκη, 2015.
13. Ι. Σχοινάς, *Ειδικά Κεφάλαια Ανωτέρων Μαθηματικών*, Εκδόσεις Ζήτη, Θεσσαλονίκη, 2004.
14. Ι. Σχοινάς, *Εξισώσεις Διαφορών και Ειδικές Συναρτήσεις*, Εκδόσεις Ζήτη, Θεσσαλονίκη, 1990.