Tennessee Technological University
Mathematics Department

MATH 4250-4260/5250-5260: Advanced Ordinary Differential Equations I-II

I.   COURSE DESCRIPTION FROM CATALOG:
Systems of ordinary differential equations, matrix methods, approximate solutions, stability theory, basic theory of nonlinear equations and differential systems, trajectories, phase space stability, construction of Liapunov functions.
Lec. 3-3. Cr. 3-3.

II.   PREREQUISITE(S):
MATH 4250 (5250): C or better in MATH 2110 and MATH 2120 (or consent of instructor for MATH 5250).
MATH 4260 (5260): C or better in MATH 4250 or 5250.

III.   COURSE OBJECTIVE(S): The principal objective is the study of stability theory in differential systems. The students will find a rigorous but elementary treatment of several topics that are of importance in modern engineering and physics.

IV.   TOPICS TO BE COVERED: Systems of Differential Equations, Linear Systems, Phase plane Analysis, Existence Theory, Stability of Systems, Liapunov's Second Method
System of Differential Equations
- Applications of Linear Algebra to Differential Equations solutions of simultaneous Linear Equations
- The Nonhomogeneus Equations
- Qualitative theory of Differential Equations
- Stability of Linear Systems
- Stability of Equilibrium Solutions
- The phase-plane
- Qualitative properties of orbits
- Phase portraits of Linear Systems
- The poincare - Bendixon Theorem
- Introduction to bifurcation theory
- Applications:
  - Predator - prey problem
  - The principle of competitive exclusion in populations biology
  - The threshold theorem of epidemiolody
- Liapunove's second method

V.   ADDITIONAL INFORMATION:
Graduate credit is earned on the basis of additional work required by the instructor per TTU Graduate Catalog.

VI.   POSSIBLE TEXTS AND REFERENCES:
The Qualitative Theory/Ordinary Differential Equations, by Brauer
Differential Equations & Dynamical Systems, 3rd ed., by Perko
Lectures on Ordinary Differential Equations, 2002, by Hurewicz

VII. ANY TECHNOLOGY THAT MAY BE USED:
Students with a disability requiring accommodations should contact the Office of Disability Services (ODS).   1
An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119.

Last Revised: 06/03/10