



ANDHRA UNIVERSITY TRANS-DISCIPLINARY RESEARCH HUB

ADVANCED TOPICS IN ORDINARY DIFFERENTIAL EQUATIONS

Unit 1: Analysis and Methods of Nonlinear Differential equations - Existence theorem - Extremal solutions - Upper and Lower solutions- Monotone Iterative method and method of quasi-linearisation - Bihari inequality-Variation of parameters

Unit 2: Boundary value problems-Sturm-Liouville problem-Green's function-Application of Boundary Value Problems-Picard's theorem

Unit 3: Stability of Linear and Nonlinear systems-Elementary critical points-System of Equations with constant coefficients-Linear equation with constant coefficients-Lyapunov Stability

Unit 4: Stability of Quasi linear systems-Second order linear differential equations- Equations with deviating arguments-Equations with constant delay - Equations with piecewise constant delay - A few other types of Delay equations

Chapters 6,7,9,11 of the Text Book

Text Book: S.G. Deo, V. Lakshmikantham and V. Raghavendra, Text book of Ordinary Differential Equations, Tata McGraw-Hill Publishing Company Limited, New Delhi.



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Time: 3 hours

Max. Marks 100

Answer any FIVE questions. All questions carry equal marks

- Establish Bihari's inequality
 - Establish Alekseev's formula
- Discuss the Monotone Iterative Method and Method of Quasilinearization
- Construct a Green's function and use it to solve a non homogeneous Boundary Value Problem.
- State and prove an existence and uniqueness theorem for solution of a BVP of type $x'' + f(t,x) = 0$, $x(a) = x(b) = 0$, t in $[a,b]$.
- Establish stability, asymptotic stability, uniform stability and uniform asymptotic stability for zero solution of an appropriate initial value problem using Lyapunov function.
- Discuss stability of Quasi-Linear systems.
- Analyse a linear delay differential equation with a constant delay and with constant coefficients.
- Analyse a delay equation of type $x'(t) = a x(t) + b x[t]$, $x(0) = c$ where a , b and c are real constants and t is non negative.