KL UNIVERSITY: GUNTUR
DEPARTMENT OF MATHEMATICS
Pre Ph.D. Examinations
Paper III: Dynamical systems on Time scales

Eight questions are to be set and the student has to answer five in three hours of duration:

UNIT-1 **Self-Adjoint equations**: Wronskian matrix, Lagrange Identity, Abel's formula, Hermitian, Riccati equation. Sturm's separation and Comparison theorems.

UNIT-2 **Linear Systems and Higher order equations**: Regressive matrices, Existence and Uniqueness theorem, matrix exponential function, Variation of constants, Liouville's Formula, Constant coefficients.

UNIT-3: **Asymptotic behavior of solutions**: Growth and dichotomy conditions, Levinson's perturbation Lemma properties and applications.

UNIT-4: Dynamic Inequalities: Grownwall's Inequality, Bernoulli's Inequality, Holders and Minkowski's inequalities.Lyapunov inequalities.

Text Book: Dynamic equations on time scales, an introduction with Applications. Martin Bohner and Allan Peterson, BirKhauser, Boston.

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Pre-Ph.D Degree Examination
MODEL QUESTION PAPER
Paper III: Dynamical systems on Time scales

Time: 3 Hours **Max.Marks:100**
Answer any FIVE questions from following, each question carries equal marks.

1. State and prove the comparison theorem for initial value problems.
2. Let A $\in \Re$ be an nxn matrix valued function on T and suppose that f: $T \to \Re^n$ is rd-continuous. Let $t_0 \in T$ and $y_0 \in \Re^n$. Then prove that the initial value problem $y^\Delta(t) = A(t)y + f(t), y(t_0) = y_0$ has a unique solution y: $T \to \Re^n$.
3. Derive Gronwall's Inequality.
4. Assume $f \in Crd$ and x(t,s) be the Cauchy function for L(x(t)= $(px^\Delta)^\Delta(t) + q(t)x^{\sigma(t)} = 0$ for all t $\in$ T then x(t)= $\int_a^t x(t,s) f(s)\Delta s$ is the solution of the initial value problem Lx=f(t), x(a)=0, $x^\Delta(a) = 0$.
5. Write the dynamic equation $x^{\Delta\Delta} - 5x^\Delta + 6x = 0$ *on* $T = \Re$ in self adjoint form. Also express the difference equation x(t+2)- 5 x(t+1)+6 x(t)=0 on T=Z in self adjoint form.
6. Let A $\in \Re$ be a 2x2 matrix valued function and assume that X is a solution of $X^\Delta = A(t)X(t)$, then prove that X satisfies Liouville's formula.
7. State and prove Lyapunov inequality.
8. Solve the vector dynamic equation $x^\Delta = \begin{pmatrix} 3 & 1 \\ -13 & -3 \end{pmatrix} x$ for any time scale T.

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