KL UNIVERISTY :: GUNTUR

DEPARTMENT OF MATHEMATICS

Pre-Ph.D. Examinations

Paper III : APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS

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

UNIT-I : Linear difference equation: First order equations, general results for linear difference equations, solving linear difference equation.

UNIT-II : Method of solving linear difference equations : Solving linear difference equations with variable coefficients, non linear equations that can be linearized, solving difference equations using z- transforms.

(Scope and treatment as in Chapter -3 of Text book (1))

UNIT- III : Single species non- age-structured population models : Simple logistic models, logistic models with time-delay effects, stochastic models of populations growth.

UNIT- IV : Age- structured populations models : Discrete-Time Discrete-age-scale population models, continuous- time discrete- age scale population models, continuous- time continuous age scale population models.

UNIT- V : Two-Species population models : A simple Prey- Predator model, some other Prey-Predator models, Prey- Predator models with time delays, models for competition.

(Scope and treatment as in Chapter -3 (UNIT- III), Sections 4.1 t0 4.4 of Chapter - 4(UNIT-IV), Chapter -5 (UNIT- V) Text book (2))

Text Books:

1. Difference equations an introduction with applications by W.G.Kelly and A.C. Peterson, Second Edition, Harcourt Academic Press, USA, 2001.
2. Mathematical Models in Biology and Medicine by J.N.Kapur, Affiliated East- West press Private Limited, New Delhi, 1992.

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MODELPAPER
Paper III: APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS

Time : 3 hours **Max. Marks : 100**

Answer any **Five** questions from following, each question carries equal marks.

1. (a) Solve the difference equation y(t+1) - t y(t) = (t+1)!, t = 1, 2, 3,… so that y(1) = 5.

   (b) Solve the equation $u(t+1) = a\dfrac{(t-r_1)(t-r_2)...(t-r_n)}{(t-s_1)(t-s_2)...(t-s_m)}u(t)$,

   where $a, r_1,..., r_n, s_1,..., s_m$ are constants.

2. (a) Let $u_1(t), u_2(t)..., u_n(t)$ be the solution of

$$p_n(t)u(t+n) + p_{n-1}(t)u(t+n-1) + ... + p_0u(t) = 0$$

   and let w(t) be the corresponding Casoratian.

   Then show that $w(t+1) = (-1)^n \dfrac{p_0(t)}{p_n(t)} w(t)$.

   (b) Find all solutions of u(t+3) – 7u(t+2) + 16u(t+1) – 12u(t) = 0.

3. (a) Solve the difference equation $\Delta y(t) = 3^t \sin \frac{\pi}{2} t$.

   (b) Solve the equation $u(t+2) - u(t+1) - \dfrac{1}{t+1}u(t) = 0$.

4. (a) Solve the difference equation y(t+2)y(t) = y(t+1).

   (b) Solve the following initial value problem using z-transform

   (k+1)y(k+1)-(50-k)y(k) = 0, y(0)=1.

5. (a). Discuss about logistic equation.

   (b).Discuss about logistic models with Time-Delay effects.

6. (a). Discuss about the stable age structure.

   (b). Discuss about Linear continuous-time model.

7. Write the basic equations for a simple continuous prey-predator model and the stability nature of the model around the equilibrium points.

8. Discuss the threshold results the model for competition interaction between two species.