**Dynamical system : first course , Lecturer: asst.prof.Dr.Sameer Qasim Hasan**

**1st. week: Linear dynamical system with constant coefficient ,**

 **coordinate transformation, with examples.**

 **2th. week: some prepositions of subspaces bases and dimension and**

 **exponentials of operators for linear dynamical system**

 **3th. week: uncoupled linear system , linear system in** $R^{2}$ **, complex**

 **eigenvalus , multiple eigenvalues for distinguish the type of equilibrium**

 **point. Some Examples of linear dynamical for all types.**

**4th. week: Jourdan conical form , fundamental theory of nonhomogenous**

 **dynamical system , some examples of transform the system from**

 **classical linear differential equation to state space system**

**5th. week: Nonlinear dynamical system , some concept and definitions , the**

 **fundamental existence –uniqueness theorems, dependence on initial**

 **conditions and parameters.**

**6th. week: some theorems of flow of a differential equations Linearization stable manifold , The Hartman-Grobman theorem**

1. **7th. week: Stability analysis of Equilibria, nonlinear sinks, stability, Liapunove functions, gradient systems.**

**8th. week:-stability by linearization ,Hamiltonian system and system with first**

 **integrals.**

**9th. week: periodic solutions ,Bendixson's criterion ,limit sets , local sections**

 **and flow boxes ,**

**10th. week: monoton sequences in planar dynamical systems, limit cycles,**

 **examples.**

**11th. week: The ponicare- bendixson theorem, some examples.**

**12th. Week: Some of linear dynamical model**

**13th. Week: Some of affine dynamical model**

**14th. Week: Some of nonlinear dynamical model**

**15th. Week: Examination**

**References:**

1. **Dynamical system and numerical analysis, by A.M. stuart and A.R. Humphries**
2. **Differential equations. Dynamical systems. And Linear Algebra , by Morris W. Hirsch and Stephen Smale.**
3. **Introduction to applied nonlinear dynamical systems and Chaos., by S. Wiggins ,2000**
4. **Ordinary differential equations and dynamical systems, by Gerald Teschi.2010**
5. **Nonlinear differential equations and dynamical systems, by Ferdinand Verhulst, springer-verlag berlin , 1990**
6. **Differential equation and Dynamical systems, by Lawrence Perko, springer-verlag.1991**
7. **Differential equations dynamical systems an introduction to chaos, morris W.Hirsch , Stephen smale , Robert l.devaney.2004**