Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2019 - 2020

Course Handout Part II

01-08-2019

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : MATH F312
Course Title : Ordinary Differential Equations
Instructor-in-Charge : **J. Jagan Mohan**
Instructors : J. Jagan Mohan, Gujji Murali Mohan Reddy

Scope and Objective of the Course:

Ordinary differential equations occur frequently as mathematical models in many branches of science, engineering and economics. For a mathematician confronted with such a model there are a number of issues to address and various approaches to choose from:

Is the problem well posed? Do you expect the differential equation to have a solution? If so, is there a unique solution satisfying the given initial or boundary conditions? Can you find an explicit analytical solution? This is only possible in rare circumstances.

Geometric or Qualitative Methods: These methods give insights into general and qualitative features of solutions of ordinary differential equations without solving them.

Stability and Dependence on Parameters: Having obtained a solution by any method, one would like to know how the solution changes if we change the initial data by a small amount (stability analysis) and if we change parameters in the differential equation (parameter dependence). This course helps deeper understanding of the complicated models that are there in the real life.

Textbooks:

1. **S. Ahmad & M.R.M. Rao**: Theory of Ordinary Differential Equations with Applications in Biology and Engineering, East West Press, 1999.

Reference books

1. Fred Brauer and John A. Nohel: The Qualitative Theory of Ordinary Differential Equations - An Introduction, Dover Publications, 1969.
2. Richard Bellman: Stability Theory of Differential Equations, Dover Publications, 2008.
3. E.A. Coddington and N. Levinson: Theory of Ordinary Differential Equations, Tata Mc Graw - Hill Publications, 1972.
4. Lawrence Perko: Differential Equations and Dynamical Systems, Springer, Third Edition, 2001.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book

1 - 2	To know the basic definitions and notations	Introduction and Overview of the Course, Notation and Definitions	Chapter 1 / Sections 1 - 2
3 - 6	To learn the existence and uniqueness theorems for scalar equations as well as general system of equations	Existence and Uniqueness of Solutions of Scalar Differential Equations	Chapter 1 / Section 3
7 - 9		Existence Theorems for System of Equations	Chapter 1 / Section 4
		Differential and Integral Inequalities (Self Study)	Chapter 1 / Section 5
10 -11	To understand the properties of linear systems	Introduction	Chapter 2 / Section 1
12 - 14		Properties of Linear Homogeneous Systems	Chapter 2 / Section 2
15 - 16		Inhomogeneous Linear Systems	Chapter 2 / Section 3
17 - 18	To understand the properties of higher order linear equations	Behavior of Solutions of *n*th order Linear Homogeneous Equations	Chapter 2 / Section 4
19 - 21		Asymptotic Behavior	Chapter 2 / Sections 5
22 - 24	To understand the concept of stability of a linear system	Introduction to Stability, Continuous Dependence and Stability Properties of Solutions	Chapter 3 / Sections 1 – 2
25 - 27	To learn the stability analysis of weakly non-linear and two dimensional systems	Linear Systems	Chapter 3 / Section 3
28 - 30		Weakly Nonlinear Systems	Chapter 3 / Sections 4
31 - 32		Two Dimensional Systems	Chapter 3 / Section 5
33 - 38	To study the Liapunov method for stability analysis	Introduction to Stability by Liapunov Second Method, Autonomous Systems, Non - Autonomous Systems	Chapter 5 / Sections 1 - 3
39 - 42	To understand the qualitative behavior of solutions of second order equations	Second Order Differential Equations, Boundedness of Solutions, Oscillatory Equations (Self Study), Classical Equations (Self Study)	Chapter 4 / Sections 1 - 5

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quiz - 1	20 Min.	5	To Be Announced	Closed

Assignment - 1	-	10	To Be Announced	Open
Mid Semester Test	90 Min.	30	3/10, 11.00 -- 12.30 PM	Closed
Assignment - 2	-	10	To Be Announced	Open
Quiz - 2	20 Min.	5	To Be Announced	Closed
Comprehensive Examination	180 Min.	40	9/12 AN	Closed

Chamber Consultation Hour: To be announced in the class.

Notices: All notices regarding MATH F312 will be displayed on CMS.

Make-up Policy: Make up of other evaluation components will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE