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## COURSE HANDOUT (PART-II)

Date: 3/8/2015

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

**Course No.** : MATH F312  
**Course Title** : Ordinary Differential Equations  
**Instructor-In-Charge** : BALRAM DUBEY  
**Instructors** :

### 1. COURSE DESCRIPTION:

Existence and uniqueness theorems; properties of linear systems; behavior of solutions of  $n$ th order equations; asymptotic behavior of linear systems; stability of linear and weakly nonlinear systems; conditions for boundedness and the number of zeros of the nontrivial solutions of second order equations; stability by Liapunov's direct method; autonomous and nonautonomous systems.

### 2. SCOPE & OBJECTIVE:

Ordinary Differential Equations frequently occurs as mathematical models in many branches of science, engineering and economy. 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, qualitative features of solutions and do not require solving the differential equation.

**Stability and dependence on parameters:** Having obtained a solution by any method, we 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). Course helps deeper understanding of the complicated models that are there in the real life.





### 3. TEXT BOOK:

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

### 4. REFERENCE BOOKS:

**R1.** The qualitative theory of ordinary differential equations, an introduction, Fred Brauner and John A Nohel, Dover Publications, 1969.

**R2.** Theory of Ordinary Differential Equations, E.A. Coddington & N. Levinson, Tata McGraw- Hill, 1972.

### 5. COURSE PLAN:

Topics to be covered	Ref. To Text Book	Lecture No.
Introduction & Overview of the course Notation and Definitions	Ch. 1 section 1 & 2	1-2
Existence and Uniqueness of Solutions of Scalar Differential Equations, Existence Theorems, Differential & Integral Inequalities	Ch.1 Section: 3 – 5	3 -8
Introduction to Linear Systems, FSS, Properties of Linear Homogeneous Systems, Inhomogeneous Linear Systems	Ch.2 Section: 1 – 3	9 -12
Behavior of Solutions of nth order Linear Homogeneous Equations, Asymptotic Behavior	Ch.2 Section: 4 – 5	13 -16
Introduction to stability, Continuous dependence and stability properties of Solutions	Ch.3 Section: 1 – 2	17 - 21
Linear Systems, Weakly Non linear Systems, Two Dimensional Systems	Ch.3 Section: 3 – 5	22 -25
Introduction to stability by Liapunov's second Method, Autonomous systems, Non Autonomous Systems	Ch.5 Section: 1 – 3	26 -35
Second order differential equations boundedness of solutions Oscillatory equations, Classical equations	Ch.4 section 1-5	36-40





## 6. EVALUATION SCHEME:

Component	Duration	Weightage (%)	Date & Time	Remarks
Mid Sem Exam	90 mins	35%	5/10 8:00 - 9:30 AM	Closed Book
Compre Exam	3 hrs	45%	1/12 FN	Open & Closed Book
Quizes/Assignments		20%		Quizes may be conducted in regular or common hour.

**7. CHAMBER CONSULTATION HOUR:** Will be announced in the class.

**8. MAKE-UP Policy:** Prior permission is needed for makeup, makeup will only be given if enough evidence is there for not being able to take regular test.

**9. NOTICES:** All notices will be displayed on the Notice Board of the Mathematics Department. Normally information will also be conveyed in the class.

Instructor-in-charge  
MATH F312

