



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

**INSTRUCTION DIVISION**  
**SECOND SEMESTER 2016-2017**  
Course Handout Part II

12-01-2017

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 F244  
Course Title : Measure and Integration  
Instructor-in-Charge : MANISH KUMAR

**1.Scope and Objective of the Course:** The objective of this course is to give a comprehensive and sound introduction to Lebesgue measure theory and integration. The concepts of several notions of convergence and convergence theorems are also covered in this course. The classical theory of Reimann integration has some obvious draw backs: Firstly, the class of Reimann integrable functions is relatively small and secondly the limiting operations often lead to insurmountable difficulties. In this courses the students will be taught how these problems are overcome in the case of Lebesgue measure theory.

**2.Textbooks:**

1. P.K. Jain, V.P. Gupta, P. Jain, *Lebesgue Measure And Integration*, New Age International Ltd, Delhi, 2nd ed., 2011.

**3.Reference books**

1. G. de Barra, *Measure Theory and integration*, New Age International Ltd, Delhi, 2003.
2. H. L. Royden, *Real Analysis*, Prentice Hall, 2005.
3. Inder Kumar Rana : *Introduction to Measure & Integration*, Narosa, Delhi 1997.

**4.Course Plan:**

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



|         |   |  |                              |
|---------|---|--|------------------------------|
| 1-3     | To make the students understand that it is impossible to define a measure for all subsets of real numbers and introducing the concepts of measurable sets | Length of an interval, Outer measure, Lebesgue measure   | Chapter 3, Sec: 3.1 to 3.3   |
| 4 - 7   | To study the properties of Measurable sets  | Properties of measurable sets, Borel sets and their measurability, Characterization of measurable sets.  | Chapter 3, Sec: 3.4 to 3.7   |
| 8       | To prove the existence of Non-measurable sets   | Non-measurable sets  | Chapter 3, Sec:3.8           |
| 9 - 15  | To study the concept of measurable functions  | Definition and Properties of measurable functions, Operations on measurable functions, Step function, continuous function, Set of measure zero, Borel measurable function; Characteristic and Simple functions | Chapter 4, Sec:4.1 to 4.9    |
| 16 - 21 | To study the almost everywhere concept and the different notions of convergence of sequence of functions  | Sequence of functions, The structure of measurable functions, almost everywhere convergence and convergence in measure   | Chapter 4 Sec: 4.11 to 4.12  |
| 22 - 34 | To study the Lebesgue Integral  | Lebesgue integral of a bounded function and its properties, Comparison of Riemann and Lebesgue integrals, Integrals of a Nonnegative measurable functions, General Lebesgue integrals, Improper Integrals      | Chapter 5 Sec: 5.2 to 5.7    |
| 35 - 40 | To study the relationship between Integration   | Dini Derivatives, Differentiation of monotone functions, Functions of  | Chapter 6, Sec: 6.1 to 6.4 & |

|  |                     |   |          |
|--|---------------------|---|----------|
|  | and Differentiation | bounded variation,<br>Differentiation of<br>an integral, Absolute<br>continuity | Sec: 6.6 |
|--|---------------------|---|----------|

#### 5.Evaluation Scheme:

| Component                 | Duration | Weightage (%) | Date & Time          | Nature of Component |
|---------------------------|----------|---------------|----------------------|---------------------|
| Test 1                    | 1 hour   | 30 %          | 23/2, 1.00 - 2.00 PM | Closed Book         |
| Test 2                    | 1 hour   | 30%           | 4/4, 1.00 - 2.00 PM  | Open Book           |
| Comprehensive Examination | 3 hours  | 40%           | 03/05 AN             | Closed Book         |

**6.Chamber Consultation Hour:** To be announced in the class.

**7.Notices:** All notices concerning this course will be displayed in CMS/Mathematics Notice Board.

**8.Make-up Policy:** Makeup will be given only for very genuine cases and prior permission has to be obtained from I/C.

**INSTRUCTOR-IN-CHARGE**

