**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS**

### FIRST SEMESTER 2020-21

**Course Handout (Part II)**

#### 17-08-2020

#### In addition to the part‑I (General Handout for all courses appended to the time table) this

#### portion gives further specific details regarding the course.

**Course No. : MATH F214**

**Course Title : Elementary Real Analysis**

**Instructor in charge: MANISH KUMAR**

**Instructors: Manish Kumar, Jhuma Sen Gupta**

**1. Scope and objective of the Course:**

The objective of this course is to train the students with the essential tools of modern mathematical analysis, train them in the art of logical, deductive & constructive thinking and thus equip them with enough background for courses that involve more in-depth mathematical analysis. Real analysis is needed in several science & engineering disciplines, in the study of dynamical systems, which are solutions of differential equations, theoretical study of differential equations, the concept of fractal & fractal dimension is usually studied in metric spaces. Riemann integral is basic integral on which advance theory of integration is developed. Integration theory is needed in the study of theoretical & numerical solutions of partial differential equations.

**2. Course Description:** Countable and uncountable sets; real numbers, metric spaces, continuous and uniformly continuous maps in metric spaces, connectedness, completeness, and compactness in a metric space, Numerical sequences and series, Riemann integral & Riemann Stieltjes Integral, Convergence & uniform convergence of the Sequence of functions, Approximation of continuous function, functions of several variables, the derivative of a function of several variables, inverse function theorem.

**3. Text Book:**

W. Rudin, Principles of Mathematical Analysis, McGraw, Hill 3rd edition, 1976.

**4. Reference Books:**

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 4th Edition, John Wiley.

2. Apostal: Mathematical Analysis, Addison Wesley,1983.

3. Kenneth Ross: Elementary Analysis, Springer International Edition 2000.

**5. Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-3 | Representation of real numbers | Ordered field, Construction of real numbers, the set of real numbers as ordered field, extended real numbers | Chapter 1, Sec: 1.1 to 1.23 |
| 4-6 | Difference between countable  & uncountable set | Finite, Countable & uncountable sets | Chapter 2, Sec: 2.1 to 2.14 |
| 7-11 | Generalization of the concept of distance to abstract sets | Metric spaces, compact sets, different  Definition of compact sets, Cantor Intersection theorem, Contraction Principle | Chapter 2, Sec: 2.15 to 2.47 |
| 12-16 | A convergence of Sequence and series of real numbers | Sequence and infinite series | Chapter: 3 |
| 17-22 | Generalization of concept of limit & continuity to metric spaces | Continuous & uniformly continuous functions& their properties | Chapter 4 |
| 23-30 | Integration with respect to a function | Riemann Stieltjes integral & properties | Chapter 6 |
| 31-38 | Distinguish between uniform & pointwise convergence of Sequence of functions. Functions not differentiable but continuous | Point & uniform convergence of functions & related properties of integrability & differentiability | Chapter 7 |
| 39-43 | How continuity & differentiability have generalization for the function of several variables | Linear Transformations, Differentiation of functions of several variables | Chapter 9 sec: 9.1 to 9.15 |

1. **Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Components** | **Duration**  **(Minutes)** | **Weightage\* (%)** | **Date & Time** | **Remarks** |
| Test I | 30 min | 15% | September 10 –September 20  (During scheduled class hour) | Open Book |
| Test II | 30 min | 15% | October 09 –October 20  (During scheduled class hour) | Open Book |
| Assignment I | ------ | 10% | To be announced later | Open Book |
| Test III | 30 min | 15% | November 10 – November 20 (During scheduled class hour) | Open Book |
| Assignment II | ------ | 10% | To be announced later | Open Book |
| Comprehensive Exam | 120 min | 35% | TBA | Open Book |

\*The total marks of all the components, taken together will be 100.

**7. Chamber consultation hour:** To be announced in the class.

**8.** **Notices:** Notices concerning this course will be displayed on the CMS Notice Board only.

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

**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

**MATH F214**