



MATHEMATICS

INTRODUCTORY COURSE IN REAL ANALYSIS

Instructor Name : P D SRIVASTAVA (IIT Kharagpur - Mathematics)

COURSE DURATION : Jan-Apr 2017 **CORE / ELECTIVE :** Core **UG / PG:** UG

PRE-REQUISITES : None

INTENDED AUDIENCE : UG and PG students of Mathematics, 1st and 2nd year B. Tech students.

INDUSTRIES APPLICABLE TO : All Universities, IIT s, IISC & IISER

COURSE OUTLINE : This is a basic course in Real Analysis which is a back bone of any course on pure & applied Mathematics and Statistics. This is a very useful course for any branch of science and engineering. The present course has been designed to introduce the subject to undergraduate/postgraduate students in science and engineering. The course contains a good introduction to each topic and an advance treatment of theory at a fairly understandable level to the students at this stage. Each concept has been explained through examples and application oriented problems

ABOUT INSTRUCTOR : Prof. P.D.Srivastava is a Professor (in HAG scale) in the department of Mathematics at IIT KGP. Professor Srivastava has 36 years of teaching and research experience. He has taught many PG and UG courses such as Mathematics I and II for B.Tech. students, Real analysis, complex analysis, functional analysis, measure theory, sequence space etc. are also taught by him for undergraduate and post graduate students of integrated courses in Mathematics. Professor Srivastava has supervised so far 13 students for their PhD degrees and approx. 50 students for M.Sc. projects. He has more than 65 research publications in national and international journal of high repute. Professor Srivastava's main research interest is functional analysis, in particular, Operator theory and sequence spaces. He has also worked in fuzzy sequence spaces and Cryptography.

COURSE PLAN

Week 1: Finite, countable & uncountable sets -3 lectures. Metric Space, Open set, Closed set, Limit point, Closure of a set -3 lectures

Week 2: Ordered set, least upper bound, greatest lower bound -2 lectures Open cover, compact set & some properties of compact set – 2 lectures, Heine-Borel theorem – 1 lecture. Weierstrass Theorem, connected Set- 1 lecture

Week 3: Limit of sequences of real number – 2 lectures. Some important limits, Ratio test, Cauchy limit theorem -4 lectures

Week 4: Some theorems on limit & Bolzano Weierstrass theorem - 2 lectures Theorems on convergent & divergent sequences- 2 lectures. Cauchy sequence & its properties- 2 lectures

Week 5: Infinite series of real numbers – 2 lectures, Comparison test for series, Absolutely convergent and conditional convergent series – 2 lectures. Some test for convergence of series-2 lectures

Week 6: Raabe's Test & its application – 1 lecture. Limit of functions, cluster point – 3 lectures

Week 7: Limit theorems for functions – 4 lectures

Week 8: Continuity of functions – 2 lectures. Properties of continuous functions & composition of continuous functions – 2 lectures

Week 9: Boundedness theorem, Bolzano theorem – 2 lectures. Uniform & absolute continuity-2lectures. Type of discontinuities – 2 lectures

Week 10: Differentiability of functions of real variables – 2 lectures. Mean value theorems – 2 lectures. Application of derivatives, mean value theorems & Darboux theorem – 2 lectures

Week 11: L'Hospital rule, indeterminate forms, Taylor's theorem – 4 lectures. Riemann, Riemann-Stieltjes integral – 2 lectures

Week 12: Existence of Riemann, Riemann-Stieltjes integral – 2 lectures Properties of Riemann-Stieltjes integral - 2 lectures. Classes of Riemann integrable functions, monotonic functions, step functions – 2 lectures