INTRODUCTORY COURSE IN REAL ANALYSIS

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IIT Kharagpur

INDUSTRY SUPPORT : All universities , Engineering colleges , IITs ,IISER etc.

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: countable & uncountable sets (3 lectures);Concepts of Metric Space (1 lectures);Open ball, closed ball, limit point of a set (1 lectures)
Week 2: Some theorems on Open & closed set (1 lectures);Ordered set, least upper bound, greatest lower bound (2 lectures);Compact set & some properties of Compact set (2 lectures)
Week 3: Heine Borel Theorem (1 lecture);Weierstrass Theorem, connected set (1 lecture);Cantor Set & its properties (1 lecture);Dense set & derived set (1 lecture);Limit of sequences of real numbers & Monotone sequence (1 lecture)
Week 4: Some important limits of sequences (1 lecture);Ratio tests, Cauchy theorems on limits of sequence of real numbers (1 lectures);Fundamental theorems on limit (1 lecture);Some results on limit & Bolzano-Weierstrass Theorem (1 lecture);Criteria for convergent sequence (1 lecture)
Week 5: Criteria for Divergent sequence (1 lecture);Cauchy sequence (1 lecture);Cauchy convergence criteria for sequences (1 lecture);Infinite series of Real numbers (1 lecture);;Convergence Criteria for series of positive real no. (1 lecture)
Week 6: Comparison test for series (1 lecture);Absolutely and Conditional convergent series and Tests (2 lectures);Ratio & Integral Tests for convergence of series (1 lecture);Raabe's test for convergence of series (1 lecture)
Week 7: Limit of functions & cluster point (2 lectures;Divergence criteria for limit (1 lecture);Various properties of limit of functions (1 lecture);Left & Right hand limits for functions (1 lecture)
Week 8: Limit of functions at infinity (1 lecture);Continuity functions (Cauchy's definition) (1 lecture);Continuity functions (Heine's definition) (1 lecture);Properties of continuous functions (2 lectures)
Week 9: Boundedness Theorem and Max-Min theorem (1 lecture);Location of root and Bolzano's theorem (1 lecture);Uniform continuity & related theorems (1 lecture);Absolute continuity& related theorems (1 lecture);Types of discontinuities & Continuity in a Metric Space (1 lectures);
Week 10: Types of discontinuities & Continuity in a Metric Space (1 lectures);Relation between continuity & compact sets (1 lecture);Differentiability of real valued functions (1 lecture);Local Max. – Min. Cauchy's and Lagrange's Mean value theorem (1 lecture);Rolle's Mean value theorems & Applications (1 lecture)
Week 11: Applications of Derivatives (1 lecture);Application of MVT & Darboux's theorem (1 lecture);L'Hospital Rule (1 lecture);Taylor's Theorem (1 lecture);Riemann/Riemann Steiltjes Integral (1lecture)
Week 12: Riemann/Riemann Steiltjes Integral (1lecture);Existence of Riemann Stieltjes Integral (1 lecture);Riemann Stieltjes Integrable functions (1 lecture);Properties of Riemann Stieltjes Integral (1 lecture);Various results of Riemann Stieltjes Integral using step function (1 lecture);Some more Results on Riemann Stieltjes Integral (1 lecture)