CALCULUS OF ONE REAL VARIABLE

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INTENDED SUPPORT : First year engineering, science and economics students with mathematics as main course.
PRE-REQUISITES : Basic Mathematics till 12th standard

COURSE OUTLINE :

This course intends to develop a thorough understanding of the fundamental aspects of calculus of single variable which is fundamental tool in Sciences, Engineering and Economics.

ABOUT INSTRUCTOR :

Prof. Joydeep Dutta is currently a Professor of Economics at the Department of Humanities and Social Sciences, IIT Kanpur. He was previously a Professor at the Department of Mathematics and Statistics at IIT Kanpur. His reseach interest primarily lies in optimization though he loves Mathematics as a whole.

COURSE PLAN :

Week 1: Lecture 1: Introduction to Numbers
Lecture 2: Countability and Uncountability
Lecture 3: Examples of Irrational numbers
Lecture 4: Functions
Lecture 5: Limits of Functions-I

Week 2: Lecture 6: Limit of Functions-II
Lecture 7: Continuous Functions
Lecture 8: Intermediate Value Theorem
Lecture 9: Maximum Value Theorem
Lecture 10: Supremum & Infimum

Week 3: Lecture 11: Derivative of a Function
Lecture 12: Rules of Differentiation
Lecture 13: Derivatives maxima & minima
Lecture 14: Rolle's Theorem and Lagrange MVT(Mean-Value Theorem)
Lecture 15: Monotonic Functions and Inverse Function

Week 4: Lecture 16: Newton's Method for solving Equations
Lecture 17: Optimization Problems
Lecture 18: Integration-I : In the style of Newton and Leibnitz
Lecture 19: Integration-II : In the spirit of Newton and Leibnitz
Lecture 20: Integration-III : Newton and Leibnitz Style

Week 5: Lecture 21: Indefinite Integrals
Lecture 22: Integration by Parts
Lecture 23: Integration of Rational Functions
Lecture 24: Trapezoidal Rule for evaluating definite integral
Lecture 25: Simpson's Rule for evaluating definite integral

Week 6: Lecture 26: Applications of Definite Integral-I
Lecture 27: Applications of Definite Integral-II
Lecture 28: Applications of Definite Integral-III
Lecture 29: Applications of Definite Integral-IV
Lecture 30: Transcendental Functions-I

Week 7: Lecture 31: Transcendental Functions-II
Lecture 32: Taylor's Expansion-I
Lecture 33: Taylor's Expansion-II
Lecture 34: Infinite Sequence-I
Lecture 35: Infinite Sequence-II

Week 8: Lecture 36: Infinite series and their convergence
Lecture 37: Tests for Convergence of a series
Lecture 38: Absolute and conditional convergence
Lecture 39: Power Series
Lecture 40: Historical Development of the Calculus