Mathematics Paper II
Calculus and Number Theory
[CORE COURSE]

Semester I	Credits: 2	Subject Code: BS12004	Lectures: 40

Course Outcomes:

At the end of this course, the learner will be able to:
- Describe various relations in Number theory.
- Explain the notion of continuity as related to functions. Learner should be able to relate an intuitive notion of continuity to the mathematical definition of continuity.
- Compare and contrast the ideas of continuity and differentiability.
- Distinguish between linear, nonlinear, partial and ordinary differential equations.
- Identify areas in mathematics and other fields where Calculus is useful.
- Work effectively with others to complete homework and class assignments.

Unit 1: Divisibility	12
- Well ordering principles - Division Algorithm (without proof) - Divisibility and its properties. - Euclid's Lemma (Without proof). - Definition of G.C.D and L.C.M, Expressing G.C.D of two integers as a linear combination of the two integers. - Relatively prime integers, Euclid's Lemma and its generalization. - Congruence relation and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables. - Euler's and Fermat's Theorems.(Without proof).Examples	

Unit 2:Limit,Continuity and Differentiability	8
- Introduction : Definition of limits: R.H.L and L.H.L with examples - Continuity and properties of continuous functions. - Differentiability - Intermediate value Theorem (without proof). - Rolle's theorem (with proof and geometric interpretation). - Lagrange's Mean Value Theorem (with proof and geometric interpretation). - Cauchy's Mean Value theorem (with proof).	

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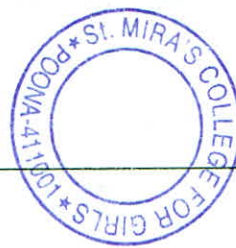| Unit 3: Applications of Differentiation	8
- Indeterminate forms. 'L' Hospital's Rule. - Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (without proof). - Taylor's and Maclaurin's Series.	

Unit 4: First Order Linear Differential Equation	6
- Introduction - Problems associated with differential equation - Linear differential equation of first order - The equations y'+ ay =0 - The equation y'+ ay =b(x) - The general linear equation of the first order	

Unit 5: Second Order Linear Differential Equation	6
- The second order linear differential equation - Linear dependence and independence - A Formula for the Wronskian.	

Recommended Text Books:

- David M. Burton *Elementary Number Theory*, McGraw-Hill Science/Engineering/Math; 7th Edition February 4, 2010.
  - Unit 1: chapter 2.2,2.3,2.4,4.2,5.2
- Earl A. Coddington, *An introduction to Ordinary Differential Equations* ., Dover Publication, Inc.
  - Unit 4,5: Chapter 1,chapter 2.3.1,2.3.2,2.3.3,2.4.1
- Tom M. Apostol*Calculus, Vol. 1: One-Variable Calculus, with an Introduction to Linear Algebra* January 16, 1991.
  - Unit 2: chapter 2,chapter 3,4.3,4.4
  - Unit 3:4.6,4.8

Reference Books:

- Bernard Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, *Discrete Mathematics Structure* Pearson Education, 5th Edition .
- William E. Boyce Edward and Richard C. *Di* Prima *Elementary Differential Equations,*

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Wiley Publication,10th Edition.
- Zukerman, *The Theory of Numbers.*

E-Resources:

- https://ocw.mit.edu/courses/mathematics/18-01sc-single-variable-calculus-fall-2010/1.-differentiation
- https://swayam.gov.in/
- https://nptel.ac.in/
- http://ocw.mit.edu

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Subject Expert (other than Parent University)	Dr. Prashant Malavadkar		Prant 01-08-2020
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