

Mathematics Paper II
Calculus and Number Theory
[CORE COURSE]

Semester I	Credits: 2	Subject Code: BS12004	Lectures: 40
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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
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• 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*,

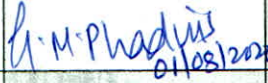

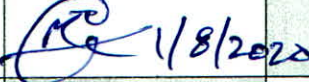

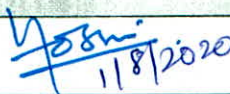
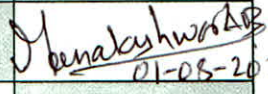

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Wiley Publication, 10th Edition.
• Zukerman, *The Theory of Numbers*.

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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Industry Expert	Mr. Anup Manakeshwar	 01-08-2020
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