

Programme	B. Sc. Mathematics Honours			
Course Code	MAT1MN103			
Course Title	<b>BASIC CALCULUS</b>			
Type of Course	<b>Minor</b>			
Semester	I			
Academic Level	100 – 199			
Course Details	Credit	Lecture/Tutorial per week	Practicum per week	Total Hours
	4	4	-	60
Pre-requisites	Basic Set Theory including functions and their algebraic operations .			
Course Summary	This course provides a comprehensive exploration of calculus and its applications: It begins with fundamental concepts of graphs, linear models, inverse functions, laying the groundwork for calculus. Modules II and III delve into differentiation techniques, including product and quotient rules, implicit differentiation, derivatives of inverse functions, and applications like extrema, theorems (such as Rolle's and Mean Value Theorems), and curve sketching. Module IV explores integral calculus, covering the fundamental theorem of calculus, numerical integration techniques (like the Trapezoidal Rule and Simpson's Rule), and introduces hyperbolic functions and their derivatives and integrals.			

### Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply graphical analysis skills to mathematical models:	Ap	C	Internal Exam/Assignment/Seminar/ Viva / End Sem Exam
CO2	Evaluate and solve calculus problems involving limits and continuity	E	C	Internal Exam/Assignment/Seminar/ Viva / End Sem Exam
CO3	Apply differentiation and integration techniques to analyse functions:	Ap	P	Internal Exam/Assignment/Seminar/ Viva / End Sem Exam
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

## Detailed Syllabus:

Text Book		Calculus: Early Transcendental Functions (6edn), Ron Larson and Bruce Edwards Cengage Learning ISBN-13: 978-1-285-77477-0.		
Module	Unit	Content	Hrs (48 +12)	Ext. Marks (70)
I	<b>Foundations of Calculus: Graphs, Functions, and Limits</b>		13	Min 15
	1	A quick review of sections 1.1 and 1.2 (not for external exam) Section 1.3 – Functions and their Graphs		
	2	Section 1.5: Inverse Functions - Inverse Functions, Existence of an Inverse Function		
	3	Section 1.6: Exponential and Logarithmic Functions - Exponential Functions, The Number $e$ , The Natural Logarithmic Function		
	4	Section 2.2: Finding Limits Graphically and Numerically - An Introduction to Limits, Limits That Fail to Exist, A Formal Definition of Limit (examples are optional topics)		
	5	Section 2.3: Evaluating Limits Analytically - Properties of Limits, A Strategy for Finding Limits,		
II	<b>Continuity, Derivatives, and Differentiation Rules</b>		12	Mn 15
	7	Section 2.4: Continuity and One-Sided Limits - Continuity at a Point and on an Open Interval, Properties of Continuity, The Intermediate Value Theorem.		
	8	Section 3.1: The Derivative and the Tangent Line Problem - The Derivative of a Function, Differentiability and Continuity		
	9	Section 3.2: Basic Differentiation Rules and Rates of Change – The Constant Rule, The Power Rule, The Constant Multiple Rule, The Sum and Difference Rules		
	10	Section 3.2 : Basic Differentiation Rules – rest of the section.		
	11	Section 3.3: Product and Quotient Rules and Higher Order Derivatives - The Product Rule, The Quotient rule, Higher- Order Derivatives		
	12	Section 3.4 The Chain Rule.		
13	Section 3.5: Implicit Differentiation Implicit and Explicit Functions, Implicit Differentiation, Logarithmic Differentiation			
III	<b>Applications of Derivatives: Extrema, Concavity, and Curve Sketching</b>		12	Min 15
	14	Section 4.1: Extrema on an Interval - Extrema of a Function, Relative Extrema and Critical Numbers, Finding Extrema on a Closed Interval		
	15	Section 4.2: Rolle’s Theorem and The Mean Value Theorem - Rolle’s Theorem, The Mean Value Theorem		
	16	Section 4.3: Increasing and Decreasing Functions and The First Derivative Test - Increasing and Decreasing Functions, The First Derivative Test		
	17	Section 4.4: Concavity and the Second Derivative Test -		

		Concavity, Points of Inflection, The Second Derivative Test		
	18	Section 4.6: A summary of Curve Sketching - Analyzing the Graph of a Function		
<b>IV</b>	<b>Integral Calculus: Fundamental Theorems and Applications"</b>			
	19	Section 5.1: Antiderivatives and Indefinite Integration – Antiderivatives, Basic Integration Rules, Initial Conditions and Particular Solutions.	11	<b>Min 15</b>
	20	Section 5.3: Reimann Sums and Definite Integrals – Reimann Sums, Definite Integrals, Properties of Definite Integrals.		
	21	Section 5.4: The Fundamental Theorem of Calculus - The Fundamental Theorem of Calculus, The Mean Value Theorem for Integrals.		
22	Section 5.4: The Fundamental Theorem of Calculus - Average Value of a Function, The Second Fundamental Theorem of Calculus, Net Change Theorem			
<b>V</b>	<b>Open Ended</b>			
		One Sided Limits and Discontinuity, Derivatives of Inverse Functions, Derivatives of Trigonometric functions, Limits at Infinity and Horizontal Asymptotes, Numerical Integration, Area problems using Riemann Sums, Hyperbolic Functions.	<b>12</b>	

**References:**

1. Calculus, Soo T. Tan, First Edition, Brooks/Cole, Cengage Learning, 2011.
2. Calculus & Analytic Geometry, (9/e), George B. Thomas & Ross L. Finney, Pearson Publications
3. Calculus, (7/e), Howard Anton, Biven, & Stephen Davis, Wiley India
4. Calculus, (7/e)., Howard Anton, Biven, & Stephen Davis, Wiley India.
5. Calculus: Early Transcendentals, (4/e), Dennis G. Zill and Warren S. Wright

**Note: 1) Optional topics are exempted for end semester examination.**

**2) Proofs of all the results are also exempted for the end semester exam.,**

**Mapping of COs with PSOs and POs :**

	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	3	2	3	2	3	1	2
CO 2	3	1	3	1	3	1	3	1	2
CO 3	2	1	3	1	3	2	3	1	2

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

	Internal Exam	Assignment	Seminar	Viva	End Semester Examinations
CO 1	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓