

**UNIVERSITY OF MADRAS**  
**B.Sc. DEGREE PROGRAMME IN MATHEMATICS**  
 SYLLABUS WITH EFFECT FROM 2023-2024

<b>Title of the Course</b>		<b>INTEGRAL CALCULUS</b>					
<b>Paper Number</b>		<b>CORE M4</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	134C2B
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4		1		--	5
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.</li> <li>• Knowledge about Beta and Gamma functions and their applications.</li> <li>• Skills to Determine Fourier series expansions.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I:</b> Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions – product of powers of exponential and trigonometric functions - Bernoulli's formula. <span style="float: right;"><b>Hours 15</b></span></p> <p><b>Chapter 1 : Sections : 13, 13.1 to 13.10, 14, 15.1</b></p>					
		<p><b>UNIT-II:</b> Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates.</p> <p><b>Chapter 5 : Sections : 1, 2.1, 2.2, 3.1. <span style="float: right;"><b>Hours 15</b></span></b></p>					
		<p><b>UNIT-III:</b> Triple integrals –applications of multiple integrals - volumes of solids of revolution – Volume of solids as double intergrals – Volume as a triple integral - areas of curved surfaces–change of variables – Jacobian – change of variable in the case of two varibles, three variables – transformation from cartesian to polar coordinates and cartesian to spherical polar coordinates. <span style="float: right;"><b>Hours 15</b></span></p> <p><b>Chapter 5 :Sections : 4, 5.1 to 5.3, 6.1 to 6.3 &amp; Section :7</b></p> <p><b>Chapter 6 : Sections: 1.1,1.2, 2.1 – 2.4</b></p>					

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	<p><b>UNIT-IV:</b> Beta and Gamma functions – infinite integral -                  Definitions – recurrence formula of Gamma functions – properties of                  Beta functions- relation between Beta and Gamma functions –                  Applications. <span style="float: right;"><b>Hours 15</b></span></p> <p><b>Chapter 7: Sections 1.1 to 1.4, 2.1, 2.3 , 3 to 6</b></p> <p><b>UNIT-V: Geometric Applications of Integrations:</b> Areas in polar                  co-ordinate, Trapezoidal Rule, Simpson’s Rule, Length of a curve –                  Cartesian co-ordinate – Polar co-ordinate– Area of surface of revolution.  <b>Chapter 2 : Sections :1.4, 2.1, 2.2, 4, 4.1, 4.2 &amp; 5</b> <span style="float: right;"><b>Hours 15</b></span></p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</b></p>	<p style="text-align: right;"><b>Total Hours:75</b></p> <p>Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved                  (To be discussed during the Tutorial hour)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Text</b></p>	<p>Calculus, Volume II, by S.Narayanan and T.K Manicavachagom Pillay. – S. Viswanathan, Publishers - 2016</p>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Calculus,H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc., 2002.</li> <li>2. Calculus,G.B. Thomas and R.L. Finney, Pearson Education, 2007.</li> <li>3. Integral Calculus and Differential Equations, D. Chatterjee, Tata- McGraw Hill Publishing Company Ltd.</li> <li>4. An Introduction to Laplace Transforms and Fourier Series, P. Dyke, Springer Undergraduate Mathematics Series, 2001 (second edition).</li> </ol>
<p><b>Website and e-Learning Source</b></p>	<p><a href="https://nptel.ac.in">https://nptel.ac.in</a>  <a href="https://mathhelp.com/">https://mathhelp.com/</a></p>

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**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO 1:** Determine the integrals of algebraic, trigonometric and logarithmic functions and to find their reduction formulae

**CLO 2:** Evaluate double and triple integrals and problems using change of order of integration

**CLO 3:** Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution

**CLO 4:** Explain beta and gamma functions and to use them in solving problems of integration

**CLO 5:** Explain Geometric and Physical applications of integral calculus

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO 1	3	1	3	-	-	-	3	2	1
CLO 2	3	1	3	-	-	-	3	2	1
CLO 3	3	1	3	-	-	-	3	2	1
CLO 4	3	1	3	-	-	-	3	2	1
CLO 5	3	1	3	-	2	1	3	2	1