UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="6">VECTOR CALCULUS AND APPLICATIONS</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE M5</td></tr>
<tr><td>Category Core</td><td>Year II
Semester III</td><td>Credits</td><td>5</td><td>Course Code</td><td>234C3A</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td>Lab Practice
--</td><td colspan="2">Total
5</td></tr>
<tr><td>Pre-requisite</td><td colspan="5">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="5">• Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.
• Skills in evaluating line, surface and volume integrals.
• The ability to analyze the physical applications of derivatives of vectors.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="5">UNIT-I: Scalar and Vector point function – level surfaces –Directional Derivative of a scalar point functions – Gradiant of a scalar point function –Summation notation for gradiant – Gradiant of f(r) .
Chapter 2 : Sections : 2.1 – 2.6 Hours: 15</td></tr>
<tr><td colspan="5">UNIT-II: Divergence and curl of a vector point function– Summation notation for divergence and curl – Laplacian differential operators , other differential operators, divergence and curl of a gradiant and divergence and curl of a curl – Examples.
Chapter 2:Sections : 2.7 – 2.13 Hours: 15</td></tr>
<tr><td colspan="5">UNIT-III: Line integrals, independence of path of integration, conservative field and scalar potential, line integral of a conservative vector.
Chapter 3: Sections : 3.1 – 3.4 Hours: 15</td></tr>
<tr><td colspan="5">UNIT-IV: Surface integrals - Volume integrals – Cylindrical and spherical polar coordinates.
Chapter 3 : Sections :3.5 – 3.7 Hours: 15</td></tr>
<tr><td colspan="5">UNIT-V: Integral theorems, Gauss' divergence Theorem, Integral theorems derived from the divergence theorem, Green's theorem in plane - Stoke's Theorem – simple problems
Chapter 4: Sections : 4.1 – 4.5 Hours: 15</td></tr>
<tr><td></td><td colspan="5">Total Hours:75</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Vector Analysis by P. Duraipandain and Kayalal Pachaiyappa S.Chand
Reference Books	1. Vector Calculus, J.C. Susan, (4th Edn.) Pearson Education, Boston, 2012. 2. Vector Calculus for College Students, A. Gorguis, Xilbius Corporation, 2014. 3. Vector Calculus, J.E. Marsden and A. Tromba , (5^{th}edn.) W.H. Freeman, New York, 1988.
Website and e-Learning Source	https://nptel.ac.in https://www.mathhelp.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find the derivative of vector and sum of vectors, product of scalar and vector point functionand to determine derivatives of scalar and vector products

CLO 2: Applications of the operator 'del' and to Explain soleonidal and ir-rotational vectors

CLO 3: Solve simple line integrals

CLO 4: Solve surface integrals and volume integrals

CLO 5: Verify the theorems of Gauss, Stoke's and Green's (Two Dimension)

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