KU6DSCMAT301: VECTOR CALCULUS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
VI	DSC	300-399	KU6DSCMAT301	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course in Vector Calculus provides students with a comprehensive understanding of parametric curves, vector valued functions, differentiation and integration techniques, surface area, surface integrals, and applications of Green's theorem, Stoke's theorem, Divergence theorem and solving physical problems and preparing for advanced studies.

Course Prerequisite

Differentiation, Integration, Vectors.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand curves in space, their tangents, normal and arc length in space.	Apply
2	Understand Directional derivatives and gradient vectors, tangent planes and differentials.	Understand
3	Understand Line integrals. Solve for work, circulation and flux using line integrals.	Understand
4	Understand path independence conservative fields and potential functions.	Apply
5	Understand Green's theorem and solve problems using Green's theorem	Apply
6	Understand Surface area and surface integrals	Understand
7	Understand Stoke's theorem, Divergence theorem and solve problems using Stoke's Theorem and Divergence theorem	Apply

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓	✓		✓			
CO 2	✓	✓					
CO 3	✓	✓					
CO 4	✓	✓					
CO 5	✓	✓		✓			
CO 6	✓	✓		✓			
CO 7	✓	✓		✓			

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**GEOMETRY OF SPACE AND MOTION IN SPACE**	**14**
	1	(a) Curves in space and their tangents	
		(b) Arc length in space	
		(c) Curvature and normal vector of a curve	
II		**PARTIAL DERIVATIVES**	**13**
	1	a) Directional derivatives and gradient vectors	
		b) Tangent planes and differentials	
III		**INTEGRATION IN VECTOR FIELDS I**	**14**
	1	a) Line integrals	
		b) Vector fields and line integrals: work, circulation and flux	
		c) Path independence, conservative fields and potential functions	
		d) Green's theorem in the plane	

IV	**INTEGRATION IN VECTOR FIELDS II**		**14**
	1	a) Surfaces and area	
		b) surface integrals	
		c) Stokes' theorem (theorem without proof) (paddle wheel interpretation of $\nabla \times F$ is excluded)	
		d) The Divergence Theorem (theorem without proof) (Gauss' law: one of the four great laws of Electromagnetic Theory, continuity equation of hydrodynamics, unifying the integral theorems are excluded)	
V	**Teacher Specific Module**		**5**
	Directions		
	a) Extreme values and saddle points		
	b) Lagrange multipliers		
	c) Partial derivatives with constrained variables		

Essential Readings

1. G.B, Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus (12^{th} edition), Pearson Education.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 13.1, 13.3, 13.4	
II	1	1	Sections 14.5, 14.6	
III	1	1	Sections 16.1, 16.2, 16.3, 16.4	*Proof of Green's Theorem excluded*

IV	1	1	Sections 16.5, 16.6, 16.7, 16.8	*Stokes' theorem (paddle wheel interpretation of $\nabla \times F$ is excluded)* *The Divergence Theorem without proof* *(Gauss' law: one of the four great laws of Electromagnetic Theory, continuity equation of hydrodynamics, unifying the integral theorems are excluded*)

Suggested Readings

1. E. Kreyzig, Advanced Engineering Mathematics (10th Edition), Wiley
2. H. F. Davis and A. D. Snider, Introduction to Vector Analysis (6th Edition), Universal Book Stall, New Delhi.
3. F. W. Bedford and T. D. Dwivedi, Vector Calculus, McGraw Hill BookCompany
4. S.S. Sastry, Engineering Mathematics, Vol 2 (4th edition), PHI
5. B.S. Grewal, Higher Engineering Mathematics (43rd edition), Khanna Publishers.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	12
c)	Seminar, Viva-Voce	6
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**