Course Code MAT1003	Calculus	Course Type: LT
		Credits: 4
		Version: 1.0

Prerequisite: Basic knowledge of 12 level calculus.

Course Objectives:

- To lay foundation for use the calculus in physics, chemistry & also in engineering subject.
- To find the rectification, area and volume of and normal or complex part by using multiple integration.
- To find errors by using differentiation as well as extreme value of functions.
- To calculate velocity gradient, work done and potential function.
- To study applications of differential equations in engineering problems.

Course Outcomes:

Students will be able to

CO1: Find the limits, continuity, Tangent planes, Extreme values and expand the functions of two variables. (KL2)

CO2: Find the area and volume by multiple integral, concept of change the order and variable of integration. (KL3)

CO3: Evaluate the gradient, divergence, directional derivative, curl, work done, rea, volume integral and surface integral using vector calculus. (KL3)

CO4: Solve differential equations and its application to engineering problems. (KL3, KL4)

Correlation of COs with POs

CO \PO	CKL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PKL		3	5	6	5	6	3	3	3	NA	M	3	M			
CO1	2	3	2	1	2	1			3	0	2	3				
CO2	3	3	2	2	2	2			3	0	2	3				
CO3	3	3	2	2	2	2			3	0	2	3				
CO4	3	3	2	2	2	2			3	0	2	3				

CO	Topics to be discussed	Lecture
CO1	**Partial derivatives** Functions of two variables, Limits and continuity, partial derivatives, Interpretations of partial derivative, differentials, Chain rule, Tangent planes, Extreme values and saddle points, Lagrange multipliers with one constraint, Taylor's formula for two variables.	**8**
CO2	**Multiple Integrals** Double integrals over rectangles and general regions – Double integrals in polar coordinates - change of order of integration - change of variables from Cartesian to polar coordinates - Triple integrals in Cartesian coordinates - change of variables from Cartesian to cylindrical and spherical co-ordinates - Applications of double and triple integrals restricted to area and volume problems	**9**
CO3	**Vector Calculus** Vector fields - Gradient, Divergence and Curl, Directional derivatives, Line integrals - work, circulation and flux - Path independence, conservative fields and potential functions - Green's Theorem (statement) - Surface & volume integrals - Stoke's Theorem (statement) - Gauss Divergence Theorem (statement), Applications to engineering problems.	**9**

CO4	**First Order Differential Equations** Introduction to first order differential equation, Solution of first order differential equation by Separation of variables, Exact method, Homogeneous equation, Linear equation, Bernoulli equation, Simultaneous differential equations, Applications to engineering problems.	**8**
CO4	**Second Order Linear Differential Equations** Introduction to second order linear differential equations with constant coefficients - general solutions of homogeneous and non-homogeneous equations - method of undetermined coefficients - method of variation of parameters - Differential equations with variable coefficients - Cauchy-Legendre and Cauchy-Euler equations, Applications to engineering problems.	**9**
	Guest Lectures by experts on contemporary topics	**2**
	Total Lectures: (1 Lecture = 1.5 hrs.)	**45**

Mode of Teaching and Learning:
Class room teaching
Use of mathematical software (MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid
Minimum of 2 hours lectures by experts on contemporary topics

Mode of Evaluation and assessment:
Digital Assignments, Continuous Assessment Tests, Final Assessment Test and unannounced open book examinations, quizzes, student's portfolio generation and assessment, innovative assessment practices.

Text Books:

1.	George B. Thomas, Maurice D. Weir, Joel R. Hass, Thomas' Calculus, 12th edition, Pearson Education Inc., 2010
2.	B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, India, 2014.
3	Dennis G. Zill, A first course in differential equations with modeling applications, Brooks/Cole Thomson Learning, 11th edition, 2018.

Reference Books:

1.	James Stewart, Calculus: Early Transcendentals, 8th Edition, Cengage Learning, 2014.
2.	Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., New Delhi, 2015.
3.	Peter V. O' Neil, Advanced Engineering Mathematics, 7th edition, Cengage Learning, 2012.

Recommendation by the Board of Studies on	**15 March 2024**
Approval by Academic council on	**23.05.2024**
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