# Calculus and its Applications
(Basics)

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Programme: M.Sc (Cyber Security)
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**LIMITS AND CONTINUITY:** Standard functions – Graphs - Limit - continuity - piecewise continuity - periodic - differentiable functions - Riemann sum - integrable functions - fundamental theorem of calculus

**SEQUENCES AND SERIES:** Sequences - increasing - decreasing - bounded - function - limit properties - Series – convergence and divergence – alternating series test - absolute convergence – ratio test - power series - Taylor series (single variable)

**FUNCTIONS OF TWO VARIABLES:** Models - partial derivative and its geometrical interpretation - Stationary points – maxima and minima - saddle points - Taylor series - Constrained maxima and minima – Lagrange multiplier method.

**MULTIPLE INTEGRALS:** Evaluation of multiple integrals – Cartesian and polar forms - Change of order of integration - Applications of multiple integrals to find area and volume.

**ORDINARY DIFFERENTIAL EQUATIONS:** Linear Differential Equations of first order - Exact differential equations - Integrating factors - Bernoulli equations - Linear Differential Equations of higher order with constant coefficients - Euler's equation with variable coefficients - Simultaneous equations - Method of variation of parameters. Modeling simple systems.

**VECTOR CALCULUS:** Vector differentiation - gradient - divergent - curl - vector integration - Greens theorem - Stokes theorem - Gauss divergence theorem (concepts only).

## TEXT BOOKS:


1. Thomas G B Jr., Maurice D Wier, Joel Hass, Frank R. Giordano, Thomas' Calculus, Pearson Education, 2018.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 2014.


## REFERENCE BOOKS:


1. Ben Orlin, Change Is the Only Constant: The Wisdom of Calculus in a Madcap World, Black Dog & Leventhal, New York, 2019.
2. Ray Wyile C and Raymond Wyile C, Advanced Engineering Mathematics, McGraw Hill, 2013.
3. Ken F. Riley, Mike P. Hobson, Stephen J. Bence, Mathematical Methods for Physics and Engineering, Cambridge University Press, 2018
4. Deborah Hughes-Hallett, Patti Frazer Lock, Andrew M. Gleason, Applied Calculus, Wiley, 2017
5. Judith A. Beecher, Judith A. Penna, Marvin L. Bittinger, College Algebra, 5th Edition, Pearson, 2016

Cartesian product of two sets - every element will be ordered pairs

Relation - subset of Cartesian product

function - set of all ordered pairs such that no two can have the same first member

every relation is a function - false

every function is a relation - true

Range subset of codomain

real valued function -- both domain and codomain are real numbers

f:X--->Y

one to one function - different elements in X will have different images in Y
f(x)=f(y) implies x=y

onto function: Range=codomain

injective surjective

Bijective function: If it is one-one and onto

many to one function:

identity function: every element will be mapped to itself f:X-->Y

$f(x)=x$

constant function: every element in the domain will be mapped to some particular element in the codomain
$f(x)=c$

into function: atleast one element in codomain which has no preimage

# THANK YOU