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C1 Differential Calculus & Integral Calculus **6 Credits (5L+1 P)**

Duration 3hrs **Marks: 100(75+25)** **75 Lectures + 15 Tutorials**

Programme: Certificate **Class: B.Sc.**	**Year: First**	**Semester: First**
Subject: Mathematics		
Course Code: B030101T	**Course Title: Differential Calculus &Integral Calculus**	

Course outcomes:

CO1: The programme outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well.

CO2: By the time students complete the course they will have wide ranging application of the subject and have the knowledge of real valued functions such as sequence and series. They will also be able to know about convergence of sequence and series. Also, they have knowledge about curvature, envelope and evolutes and trace curve in polar, Cartesian as well as parametric curves.

CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering.

CO4: The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level Course in mathematics.

Credits:4	**Core Compulsory/Elective**
Max.Marks:25+75	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:4-0-0

Part- A

Differential Calculus

Unit	Topics	No. of Lectures
I	**Introduction to Indian ancient Mathematics and Mathematicians should be included under Continuous Internal Evaluation (CIE).** Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, subsequence, Series of non-negative terms, convergence and divergence, Comparison tests, Cauchy's integral test, Ratio tests, Root test, Raabe's logarithmic test, De Morgan and Bertrand's tests, Alternating series, Leibnitz's theorem, absolute and conditional convergence.	9
II	Limit, continuity and differentiability of function of single variable, Cauchy's definition, Heine's definition, equivalence of definition of Cauchy and Heine, Uniform continuity, Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, Extreme value theorem, Darboux's intermediate value theorem for derivatives, Chain rule, indeterminate forms.	7
III	Rolle's theorem, Lagrange and Cauchy Mean value theorems, mean value theorems of higher order, Taylor's theorem with various forms of remainders, Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's Theorem on homogeneous function.	7

IV	Tangent and normal, Asymptotes, Curvature, Envelops and evolutes, Tests for concavity and convexity, Points of inflexion, Multiple points, Parametric representation of curves and tracing of parametric curves, Tracing of curves in Cartesian and Polar forms.	**7**

Part-B
Integral Calculus

Unit	Topics	No.of Lectures
V	Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of Integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration.	**9**
VI	Improper integrals, their classification and convergence, Comparison test, μ-test, Abel's test, Dirichlet's test, quotient test, Beta and Gamma functions.	**7**
VII	Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals, change of order of double integration, Dirichlet's theorem, Liouville's theorem for multiple integrals.	**7**
VIII	Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.	**7**

Suggested Readings(Part-A Differential Calculus):

1. R.G. Bartle & D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons
2. T. M. Apostal, Calculus Vol.I, John Wiley & Sons Inc.
3. S. Balachandra Rao & C. K. Shantha, Differential Calculus, New Age Publication.
4. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc.,2002.
5. G.B. Thomas and R.L. Finney, Calculus, PearsonEducation,2007.
6. Suggestive digital platforms weblinks: NPTEL/SWAYAM/MOOCS
7. Course Books published in Hindi maybe prescribed by the Universities.

Suggested Readings (Part-B Integral Calculus):

1. T.M. Apostal, Calculus Vol.II, John Wiley Publication
2. Shanti Narayan & Dr. P. K. Mittal, Integral Calculus, S. Chand
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
4. Suggestive digital platforms weblinks: NPTEL/SWAYAM/MOOCS
5. Course Books published in Hindi may be prescribed by the Universities.

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Chemistry/Biochemistry/Life Sciences (UG), Economics (UG/PG), Commerce (UG), BBA/BCA, B.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max.Marks:25

SN	Assessment Type	Max. Marks
1	**Class Tests**	**10**
2	**Online Quizzes/Objective Tests**	**5**
3	**Presentation**	**5**
4	**Assignment (Introduction to Indian ancient Mathematics and Mathematicians).**	**5**

Course pre requisites: To study this course, a student must have subject Mathematics in class 12^{th}

Suggested equivalent online courses:

Further Suggestions:

Practical

Programme: Certificate **Class: B.Sc.**	**Year: First**	**Semester: First**
Subject: Mathematics		
Course Code: B030102P	**Course Title: Practical**	

Course outcomes:

CO1: The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica /MATLAB/Maple /Scilab/Maxima etc.

CO2. After completion of this course student would be able to know the convergence of sequences through plotting, verify Bolzano-Weierstrass theorem through plotting the sequence, Cauchy's root test by plotting n^{th} roots and Ratio test by plotting the ratio of n^{th} and $(n+1)^{th}$ term.

CO3. Student would be able to plot Complex numbers and their representations, Operations like addition, substraction, Multiplication, Division, Modulus and Graphical representation of polar form.

CO4: Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors,
Eigen values, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.

Credits:2	**Core Compulsory/Elective**
Max.Marks:25+75	**Min. Passing Marks:**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:0-0-4

Unit	Topics	No. of Lectures
	Practical /Lab work to be performed in Computer Lab. List of the practicals to be done using Mathematica /MATLAB/Maple/Scilab/Maximaetc. 1.Plottingthegraphsofthefollowingfunctions: (i) ax (ii) [x] (greatest integer function) (iii) x^{2n}; n∈N (iv) x^{2n-1}; n∈N (v) $\frac{1}{x^{2n-1}}; n \in N$ (vi) $\frac{1}{x^{2n}}; n \in N$ (vii) $\sqrt{ax+b},\ |ax+b|, c+|ax+b|$ (viii) $\frac{\|x\|}{x}, Sin\left(\frac{1}{x}\right), x\ Sin\left(\frac{1}{x}\right), e^{x}, e^{-x}\ for\ x \neq 0.$ (ix) $e^{ax+b}, \log(ax+b), \frac{1}{ax+b}, Sin(ax+b), Cos(ax+b), \|Sin(ax+b)\|, \|Cos(ax+b)\|.$ Observe and discuss the effect of changes in the real constants a and b on the graphs. (2) By plotting the graph find the solution of the equation $x=e^x$, $x^2+1=e^x$, $1-x^2=e^x$, $x=\log_{10}(x)$, $\cos(x)=x$, $\sin(x)=x$, $\cos(y)=\cos(x)$, $\sin(y)=\sin(x)$ etc (3) Plotting the graphs of polynomial of degree 2,3,4 and 5, and their first and second derivatives.	

	(4) Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypo cycloid etc. (5) Tracing of conic in Cartesian coordinates. (6) Graph of circular and hyperbolic functions. (7) Obtaining surface of revolution of curves. (8) Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form. (9) FindnumbersbetweentworealnumbersandplottingoffiniteandinfinitesubsetofR. (10) Matrix Operations: Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations. (11) Study the convergence of sequences through plotting. (12)Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot. (13) Study the convergence/divergenceofinfiniteseriesbyplottingtheirsequencesofpartial sum. (14) Cauchy's root test by plotting *n*-th roots. (15) Ratio test by plotting the ratio of *n*-th and (*n*+1)-th term.	

Suggested Readings

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG),Chemistry/Biochemistry/Life Sciences(UG), Economics (UG/PG), Commerce (UG), BBA/BCA, B.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max.Marks:25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/Objective Tests	5
3	Presentation	5
4	Assignment	5

Course pre requisites: To study this course, a student must have subject Mathematics in class 12^{th}

Suggested equivalent online courses:

Further Suggestions:

ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)
U.P. STATE GOVERNMENT UNIVERSITY,
(Recognised Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE)

C4 Matrices and Differential Equations & Geometry **6 Credits (5L+1 T)**

Duration 3hrs **Marks: 100(75+25)** **75 Lectures + 15 Tutorials**

Programme: Certificate **Class: B.Sc.**	**Year: First**	**Semester: Second**
Subject: Mathematics		
CourseCode:B030201T	**Course Title: Matrices and Differential Equations & Geometry**	

Course outcomes:

CO1: The subjects of the course are designed in such a way that they focus on developing mathematical skills in algebra, calculus and analysis and give in depth knowledge of geometry, calculus, algebra and other theories.

CO2: The student will be able to find the rank, eigen values of matrices and study the linear homogeneous and non-homogeneous equations. The course in differential equation intends to develop problem solving skills for solving various types of differential equation and geometrical meaning of differential equation.

CO3: The subjects learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surface by using analytical geometry.

CO4: On successful completion of thecoursestudentshavegainedknowledgeaboutregulargeometricalfiguresandtheirproperties.Theyhavethe Foundation for higher course in Geometry.

Credits:6	**Core Compulsory/Elective**
Max.Marks:25+75	**Min. Passing Marks:**
TotalNo.ofLectures-Tutorials-Practical(inhoursperweek):L-T-P:6-0-0	

PART-A
Matrices and Differential Equations

Unit	Topics	No. of Lectures
I	Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a System of linear equations.	**12**
II	Eigen values, Eigen vectors and characteristic equation of a matrix, Caley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and Hyperbolic functions.	**11**
III	Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.	**11**
IV	First order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy-Euler form.	**11**

PART-B

Geometry

Unit	Topics	No. of Lectures
V	General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	**12**
VI	Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension.	**11**
VII	Sphere, Cone and Cylinder.	**11**
VIII	Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equations.	**11**

Suggested Readings (PART-A Matrices and Differential Equations):

1. Stephen H. Friedberg, A. JInsel & L. E. Spence, Linear Algebra, Person
2. B. Rai, D. P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa
3. D.A. Murray,IntroductoryCourseinDifferentialEquations,OrientLongman
4. Suggested digital plateform :NPTEL/SWAYAM/MOOCs
5. Course Books published in Hindi maybe prescribed by the Universities.

Suggested Readings(Part-B Geometry):

1. Robert J.T Bell, Elementary Treat is e on Coordinate Geometry of three dimensions, Mac millan India Ltd.
2. P.R.Vittal,AnalyticalGeometry2d&3D,Pearson.
3. S.L.Loney,TheElementsofCoordinateGeometry,McMillanandCompany,London.
4. R.J.T.Bill,ElementaryTreatiseonCoordinateGeometryofThreeDimensions,McMillanIndiaLtd.,1994.
5. Suggested digital plate form :NPTEL/SWAYAM/MOOCs
6. Course Books published in Hindi may be prescribed by the Universities.

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Economics (UG/PG), Commerce (UG), BBA/BCA, B.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max.Marks:25

SN	Assessment Type	Max. Marks
1	**Class Tests**	**10**
2	**Online Quizzes/Objective Tests**	**5**
3	**Presentation**	**5**
4	**Assignment**	**5**

Course prerequisites: To study this course, a student must have subject mathematics in class 12^{th}

Suggested equivalent online courses:

Further Suggestions:

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