B. Sc. (Mathematics)
Programme Code: SCW03(M)BSC

SYLLABUS

(As per NEP 2020 Guidelines)

Ref. No. : ....

Date : ....

DEPARTMENT OF MATHEMATICS
PROPOSED STRUCTURE OF UG MATHEMATICS SYLLABUS
According to National Education Policy-2020
For first three years of Higher Education (UG)

SEMESTER WISE TITLES OF THE PAPER IN UG MATHEMATICS COURSE					
YEAR	SEMESTER	COURSE CODE	PAPER TITLE	THEORY/PRACTICAL	CREDIT
CERTIFICATE COURSE IN APPLIED MATHEMATICS					
FIRST YEAR	I	BS2430101T	Differential Calculus & Integral Calculus	THEORY	4
		BS2430102P	PRACTICAL	PRACTICAL	2
	II	BS2430201T	Matrices and Differential Equations & Geometry	THEORY	6
DIPLOMA IN MATHEMATICS					
SECOND YEAR	III	BS2430301T	Algebra & Mathematical Methods	THEORY	6
	IV	BS2430401T	Differential Equations & Mechanics	THEORY	6
DEGREE IN MATHEMATICS					
THIRD YEAR	V	BS2430501T	Group and Ring Theory & Linear Algebra	THEORY	5
		BS2430502T	Differential Geometry & Tensor Analysis	THEORY	5
	VI	BS2430601T	Metric Space & Complex Analysis	THEORY	4
		BS2430602T	Numerical Analysis & Operations Research	THEORY	4
		BS2430603P	PRACTICAL	PRACTICAL	2

Programme Outcome/ Programme Specific Outcome

Programme Outcome:

PO1: It is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for the same.

PO2: It is to develop enhanced quantitative skills and pursuing higher mathematics and research as well.

PO3: Students will be able to develop solution-oriented approach towards various issues related to their environment.

PO4: Students will become employable in various govt. and private sectors

PO5: Scientific temper in general and mathematical temper in particular will be developed in students.

Programme Specific Outcome:

PSO1: Student should be able to possess recall basic idea about mathematics which can be displayed by them.

PSO2: Student should have adequate exposure to many aspects of mathematical sciences.

PSO3: Student is equipped with mathematical modeling ability, critical mathematical thinking, and problem solving skills etc.

PSO4: Student should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management etc.

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Programme: Certificate Class: B.Sc.	Year: First	Semester: First

	Subject: Mathematics	
Course Code: BS2430101T	Course Title: Differential Calculus& Integral Calculus	

Course outcomes:

CO1: The programme outcomes 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's and Heine's, 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

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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, Pappu's 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

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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, Pearson Education, 2007.

6. H. S. Dhami, Differential Calculus, New Age Publisher

7. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCS

Suggested Readings (Part-B Integral Calculus):

8. T. M. Apostal, Calculus Vol. II, John Wiley Publication

9. Shanti Narayan & Dr. P.K. Mittal, Integral Calculus, S. Chand

10. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

11. H. S. Dhami, Integral Calculus, New Age Publisher

12. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCS

	Suggested Continuous Evaluation Methods: Max. Marks: 25	
SN	**Assessment Type**	**Max. Marks**
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation/ Research Orientation assignment	5
4	Assignment (Indian Ancient Mathematics and Mathematicians).	5

B.Sc. I (SEMESTER-I) Paper-II Practical

Programme: Certificate	Year: First	Semester: First
Class: B.Sc.		

Subject: Mathematics	
Course Code: BS2430102P	Course Title: Practical

Course outcomes:

CO1: The main objective of the course is to equip the student to plotthe different graph andsolve the different types of equations by plottingthe 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 theconvergence 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 nth and $(n+1)^{th}$ term.

CO3.Student would be able toplotComplex numbers and their representations, Operations like addition, substraction, Multiplication, Division, Modulus ndGraphical representation of polar form.

CO4: Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues, 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 R/Python/Mathematica /MATLAB /Maple /Scilab/Maxima etc. 1. Plotting the graphs of the following functions: (i) ax (ii) $[x]$(greatest integer function) (iii) x^{2n} : $n \in N$ (iv) x^{2n-1} ; $n \in N$ (v) $\frac{1}{x^{2n-1}}$;$n \in N$ (vi) $\frac{1}{x^{2n}}$;$n \in N$ (vii) $\sqrt{ax+b}$, $\|ax+b\|$, $c \pm \|ax+b\|$ (ix) $\frac{\|x\|}{x}$, $\sin\left(\frac{1}{x}\right)$, $x\sin\left(\frac{1}{x}\right)$, e^x, e^{-x} for $x \neq 0$. (x) 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 aand b on the graphs. (2) By plotting the graph find thesolution 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 secondderivatives.	

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(4) Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid 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) Find numbers between two real numbers and plotting of finite and infinite subset of R.

(10) Study the convergence of sequences through plotting.

(11) Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.

(12) Study the convergence/divergence of infinite series by plotting their sequences of partial sum.

(13) Cauchy's root test by plotting n-th roots.

(14) Ratio test by plotting the ratio of n-th and $(n + 1)$-th term.

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

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B.Sc. I (SEMESTER-II) PAPER-I Matrices and Differential Equations & Geometry

Programme: Certificate Class: B.Sc.	Year: First	Semester: Second
	Subject: Mathematics	
Course Code: BS2430201T	**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, Eigenvalues 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 the course students have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in Geometry.

Credits: 6	Core Compulsory / Elective
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): 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	Eigenvalues, Eigenvectors and characteristic equation of a matrix, Cayley-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

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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, Direction Cosines & Ratios, Projections, Planes (Cartesian and vector form), Straight lines in three dimensions.	11
VII	Sphere, Cone and Cylinder.	15
VIII	Central conicoids, Paraboloids.	7

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

1. Stephen H. Friedberg, A. J Insel & 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, Introductory Course in Differential Equations, Orient Longman.

4. A. C. Yadav, Matrices & Linear Algebra with GAP, Educreation Publishing.

5. Suggested digital plate form: NPTEL/SWAYAM/MOOCs.

6. M. D. Rai Singhania, Ordinary and Partial Differential Equations, S. Chand Pub.

Suggested Readings (Part-B Geometry):

1. Robert J. T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.

2. P. R. Vittal, Analytical Geometry 2d & 3D, Pearson.

3. S. Narayan & P. K. Mittal, 3-dimensional Geometry, S. Chand.

4. S. L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.

5. Suggested digital platform: NPTEL/SWAYAM/MOOCs.

Suggested Continuous Evaluation Methods: Max. Marks: 25

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

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