KLE Society's

R. L. Science Institute (Autonomous), Belagavi

Department of Mathematics

NATIONALEDUCATIONPOLICY-2020 SYLLABUS

FOR

First year B.Sc.(Hons)Mathematics, B.Sc. with Mathematics as a Major/Minor Subject

2021-22

Contents of Courses for B.Sc. with Mathematics as Major Subject & B.Sc.(Hons) Mathematics
ModelIIA

Semester	CourseNo.	Theory/Practical	Credits	PaperTitle	Marks	
					S.A.	I.A.
I	MATDSCT1.1	Theory	4	Algebra-I and Calculus-I	70	30
	MATDSCP1.1	Practical	2	Theory based Practical's on Algebra-I and Calculus-I	35	15
	MATOET1.1	Theory	3	(A) Mathematics–I	70	30
II	MATDSCT2.1	Theory	4	Algebra-II and Calculus-II	70	30
	MATDSCP2.1	Practical	2	Theory based Practical's on Algebra-II and Calculus-II	35	15
	MATOET2.1	Theory	3	(A) Mathematics–II	70	30
Exit Option with Certificate						
III	MATDSCT3.1	Theory	4	Ordinary Differential Equations and Real Analysis-I	70	30
	MATDSCP3.1	Practical	2	Theory based Practical's on Ordinary Differential Equations and Real Analysis-I	35	15
	MATOET3.1	Theory	3	(A) Ordinary Differential Equations (B) Quantitative Mathematics	70	30
IV	MATDSCT4.1	Theory	4	Partial Differential Equations and Integral Transforms	70	30
	MATDSCP4.1	Practical	2	Theory based Practical's on Partial Differential Equations and Integral Transforms	35	15
	MATOET4.1	Theory	3	(A) Partial Differential Equations (B) MathematicalFinance	70	30
Exit Option with Diploma						
V	MATDSCT5.1	Theory	3	Rea l Analysis and Complex Analysis	70	30
	MATDSCP5.1	Practical	2	Theory based Practical's on Real Analysis and Complex Analysis	35	15
	MATDSCT5.2	Theory	3	Ring Theory	70	30
	MATDSCP5.2	Practical	2	Theory based Practical's on Ring Theory	35	15
	MATDSET5.1	Theory	3	(A) Vector Calculus (B) Mechanics (C) Mathematical Logic	70	30
VI	MATDSCT6.1	Theory	3	Linear Algebra	70	30
	MATDSCP6.1	Practical	2	Theory based Practical's on Linear Algebra	35	15

	MATDSCT6.2	Theory	3	Numerical Analysis	70	30
	MATDSCP6.2	Practical	2	Theory based Practical's on Numerical Analysis	35	15
	MATDSET6.1	Theory	3	(A) Analytical Geometry in 3D (B) NumberTheory (C) SpecialFunctions (D) History of Bhârtîya Gaṇita	70	30
Exit Option with Bachelor of Science, B.Sc. Degree						
VII	MATDSCT7.1	Theory	3	Discrete Mathematics	70	30
	MATDSCP7.1	Practical	2	Theory based Practical's on Discrete Mathematics	35	15
	MATDSCT7.2	Theory	3	Advanced Ordinary Differential Equations	70	30
	MATDSCP7.2	Practical	2	Theory based Practical's onAdvancedOrdinaryDifferential Equations	35	15
	MATDSCT7.3	Theory	4	Advanced Analysis	70	30
	MATDSET7.1	Theory	3	(A) GraphTheory (B) Entire and Meromorphic Functions (C) General Topology (D) Bhâratîya Trikoṇmiti Śâstra	70	30
	MATDSET7.2	Theory	3	Research Methodology in Mathematics	70	30
VIII	MATDSCT8.1	Theory	4	Advanced Complex Analysis	70	30
	MATDSCT8.2	Theory	4	Advanced Partial Differential Equations	70	30
	MATDSCT8.3	Theory	3	Fuzzy Sets and fuzzy Systems	70	30
	MATDSET8.1	Theory	3	(A) Operations Research (B) Lattice theory and Boolean Algebra (C) Mathematical Modelling (D) *Aṅkapâśa*(Combinatorics)	70	30
	MATDSET8.2	Research Project	6(3+3)	Research Project* OR Any Two of the following electives (A) Finite Element Methods (B) Cryptography (C) Information Theory and Coding (D) Graph Theory and Networking	140 OR 70 70	60 OR 30 30
Award of Bachelor of Science Honours,B.Sc.(Hons)Degree in Mathematics						

One Year M.Sc. degree in Mathematics(Two Semesters)

Semester	CourseNumber	Theory/Practical	Credits	TitleoftheCourse	S.A.	I.A.
I	PGMATDSCT1.1	Theory	3	C++Programmingfor Mathematics	70	30
	PGMATDSCP1.1	Practical	2	ComputerPractical'sonC++ ProgrammingforMathematics	35	15
	PGMATDSCT1.2	Theory	3	ComputationalNumerical Methods	70	30
	PGMATDSCP1.2	Practical	2	ComputerPractical'sonCNM	35	15
	PGMATDSCT1.3	Theory	4	FunctionalAnalysis	70	30
	PGMATDSET1.1	Theory	3	(A) FluidMechanics–I (B) Computational FluidMechanics (C) ContactGeometry (D) FuzzyTopology (E) RamanujanThetaFunctionandContinuedFractions	70	30
	PGMATDSET1.2	Theory	3	(A) AdvancedGraphTheory (B) PartitionTheory (C) AlgebraicNumberTheory (D) RiemannianGeometry	70	30
II	PGMATDSCT2.1	Theory	4	MeasureTheory	70	30
	PGMATDSCT2.2	Theory	4	DifferentialGeometry	**70**	**30**
	PGMATDSCT2.3	Theory	3	MathematicalMethods	70	30
	PGMATDSET2.1	Theory	3	(A) FluidMechanics–II (B) Magnetohydrodynamics (C) Finsler Geometry and Relativity (D) MathematicalModelling	70	30
	PGMATDSET2.2	Project	6	ResearchProject	140	60

AbbreviationforMATDSCT1.1/MATDSCP1.1

MAT–Mathematics;DSC– DisciplineCore;T–Theory/P–Practical;1–FirstSemester;1–Course1

PGMATDSCT1.1:PG-PostGraduate;MAT-Mathematics;DSC-DisciplineCore;T-Theory, 1–First Semester;.1–Course1

B.Sc.withMathematicsasaMinorinthe3rdYear

Semester	CourseNo.	Theory/Practical	Credits	PaperTitle	Marks	
					S.A.	I.A.
V	MATDSCMT5.1	Theory	3	Complex Analysis	70	30
	MATDSCMP5.1	Practical	2	Theory based Practical's on Complex Analysis	35	15
VI	MATDSCMT6.1	Theory	3	Numerical Analysis	70	30
	MATDSCMP6.1	Practical	2	Theory based Practical's on Numerical Analysis	35	15

AbbreviationforMATDSCMT5.1/MATDSCMP5.1
MAT–Mathematics;**DSC**–DisciplineCore;**M**–Minor;**T**–Theory/**P**–Practical;
5–FifthSemester;**.1**–Course1

Syllabus for B.Sc. with Mathematics as Major Subject & B.Sc.(Hons) Mathematics

SEMESTER–I

MATDSCT1.1:Algebra-I and Calculus–I	
Teaching Hours:4Hours/Week	**Credits:4**
Total Teaching Hours:56Hours	**Max.Marks:100 (S.A.-70+I.A.–30)**

Course Learning Outcomes: This course will enable the students to

CO1: Learn to solve system of linear equations and Solve the system of homogeneous and non-homogeneous linear of *m* equation sin*n.* And Variables by using concept of rank of matrix, finding eigen values and eigen vectors.

CO2: Sketch curves in Cartesian, polar and pedal equations.

CO3:. Students will be familiar with the techniques of integration and differentiation of function with real variables.

CO4: Identify and apply the intermediate value theorems and L'Hospital rule.

Unit-I: Matrix: Recapitulation of Symmetric and Skew Symmetric matrices, Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof).AlgebraofMatrices;RowandcolumnreductiontoEchelonform.Rankofamatrix;Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria forexistence of non-trivial solutions of homogeneous system of linear equations. Solution ofnon-homogeneous system of linear equations. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties,reduction of such matrices to diagonal form, **14Hours**

Unit-II:Co-ordinate System: Polar coordinates, angle between the radius vector andtangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms-center of curvature, asymptotes, evolutes and envelops. **14Hours**

Unit-III: Differential Calculus-I: Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule. **14Hours**

Unit-IV:Successive Differentiation: n^{th} Derivatives of Standard functions e^{ax+b}, $(ax+b)^n$, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$, Leibnitz theorem and its applications. Concavity, Convexity, Singular points, point of inflection, Tracing of curves(standardcurves) **14 Hours**

ReferenceBooks:

1. University Algebra-N.S.Gopala Krishnan, New Age International(P)Limited
2. Theory of Matrices-B S Vatsa, New Age International Publishers.
3. Matrices-AR Vasista, Krishna Prakashana Mandir.
4. Differential Calculus- ShantiNarayan, S.Chand &Company,NewDelhi.
5. Applications of Calculus, Debasish Sengupta, Books and Allied(P)Ltd.,2019.
6. Calculus–LipmanBers,Holt,Rinehart &Winston.
7. Calculus-S N arayanan & T.K.Manicavachogam Pillay,S.Viswanathan Pvt.Ltd., vol.I &II.
8. Schaum'sOutlineofCalculus-Frank Ayres and Elliott Mendelson, 5thed. USA:Mc.Graw.

MATDSCP1.1:Practical's on Algebra-I and Calculus–I	
Practical Hours:4Hours/Week	**Credits:2**
Total Practical Hours:56Hours	**Max.Marks:50 (S.A.-35+I.A.–15)**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open-Source Software(FOSS)* tools for computerprogramming
- Solve problem on algebra and calculus theory studied in **MATDSCT1.1** byusing FOSS software's.
- AcquireknowledgeofapplicationsofalgebraandcalculusthroughFOSS

Practical/Lab Work to be performed in Computer Lab (FOSS)

SuggestedSoftware's:Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.Introduction

to the software and commands related to the topic.

1. Computation of addition and subtraction of matrices,
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Finding the nth Derivative of e^{ax}, trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$.
10. Finding the Taylor's and Maclaurin's expansions of the given functions.
11. Finding the angle between nth radius vector and tangent.
12. Finding the curvatures of the given curves.
13. Tracing of standard curves

OpenElectiveCourse

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

MATOET1.1: Matrices and Calculus	
Teaching Hours:3Hours/Week	**Credits:3**
Total Teaching Hours:42Hours	**Max.Marks:100 (S.A.-70+I.A.–30)**

Course Learning Outcomes: This course will enable the students to

CO1: Learn to solve system of linear equations. Solve the system of homogeneous and non-homogeneous linear equations by using the concept of rank of matrix, finding eigen values and eigen vectors.

CO2: Students will be familiar with the techniques of differentiation of function with real variables. Identify and apply the intermediate value theorems and L'Hospitalrule.

CO3: Learn to traces on standard curves.

Unit-I: Matrices: Recapitulation of Symmetric and Skew Symmetric matrices, Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties, reduction of such matrices to diagonal form, **14Hours**

UnitII: Differential Calculus: Limits, Continuity, Differentiability and properties. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurian's series, Indeterminate forms and examples. **14Hours**

Unit-III: Successive Differentiation: n^{th} Derivatives of Standard functions e^{ax+b}, $(ax+b)^n$, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$, Leibnitz theorem and its applications. **14Hours**

ReferenceBooks:

1. University Algebra-N.S.Gopala Krishnan, New Age International(P) Limited
2. Theory of Matrices-B S Vatsa, New Age International Publishers.
3. Matrices–A.R.Vasista,Krishna Prakashana Mandir.
4. Applications of Calculus, Debasish Sengupta, Books and Allied(P)Ltd.,2019.
5. Differential Calculus-ShantiNarayan,S.Chand&Company,NewDelhi.
6. Calculus–Lipman Bers,Holt,Rinehart&Winston.
7. Calculus–S.Narayanan&T.K.Manica vachogam Pillay, S.Viswanathan Pvt.Ltd., vol.I&II.
8. Schaum's Outline of Calculus-Frank Ayres and Elliott Mendelson, 5thed. USA:Mc.Graw.

SEMESTER–II

MATDSCT2.1:Algebra-II and Calculus–II	
Teaching Hours:4 Hours/Week	**Credits:4**
Total Teaching Hours:56 Hours	**Max.Marks:100 (S.A.-70+I.A.–30)**

Course Learning Outcomes: This course will enable the students to

CO1: Link the fundamental concepts of groups and symmetries of geometrical objects.
CO2: Recognize the mathematical objects called Groups. Explain the significance of the notions of Cosets, normal subgroups and factor groups.
CO3: Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
CO4: Find the extreme values of functions of two variables.

Unit-I:Real Number System: Recapitulation of number system. Countable and uncountable sets, standard theorems. Real line, bounded sets, suprimum and infimum of aset, completeness properties of R, Archimedean property of R. Intervals, neighborhood of a point, open sets, closed sets, limit points and Bolzano-Weierstrass theorem (Withoutproof). **14hours**

Unit-II:Groups: Definition of a group with examples and properties, congruence, problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's ϕ function. **14hours**

Unit-III: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin'sseries for functions of two variables, Maxima-Minima of functions of two variables. **14hours**

Unit-IV: Integral Calculus: Recapitulation of definite integrals and its properties. *Lineintegral*: Definition of line integral and basic properties, examples on evaluation of lineintegrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using double integral. *Tripleintegral*: Definition of triple integrals and evaluation-change of variables, volume a striple integral. Differentiation under the integral sign by Leibnitz rule. **14hours**

ReferenceBooks:

1. Topics in Algebra, I N Herstein, Wiley Eastern Ltd. ,New Delhi.
2. Higher algebra, Bernard &Child,Arihant,ISBN:9350943199/9789350943199.
3. Modern Algebra, Sharma and Vasista, Krishna Prakashan Mandir, Meerut, U.P.
4. Differential Calculus, Shanti Narayan,S.Chand &Company,NewDelhi.
5. Integral Calculus, Shanti Narayan and P K Mittal,S.Chand and Co.Pvt.Ltd.,
6. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5the d.USA:Mc.GrawHill.,2008.
7. Mathematical Analysis,SCMalik,WileyEastern.
8. A Course in Abstract Algebra, Vijay K Khanna and S K B hambri, Vikas Publications.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand &Company.

PRACTICAL

MATDSCP2.1: Algebra-II and Calculus–II	
Practical Hours:4Hours/Week	**Credits:2**
Total Practical Hours:56Hours	**Max.Marks:50 (S.A.-35+I.A.–15)**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open-Source Software(FOSS)*tools for computer programming
- Solve problem on algebra and calculus by using FOSS software's.
- AcquireknowledgeofapplicationsofalgebraandcalculusthroughFOSS

Practical/Lab Work to be performed in Computer Lab

Suggested Software's: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.

1. Program for verification of binary operations.
2. Program to construct Cayley's table and test abelian for given finite set.
3. Program to find all possible cosets of the given finite group.
4. Program to find generators and corresponding possible subgroups of a cyclic group.
5. Programs to verification of Lagrange's theorem with suitable examples.
6. Program to verify the Euler's ϕ function for a given finite group.
7. Program to verify the Euler's theorem and its extension.
8. Programs to construct series using Maclaurin's expansion for functions of two variables.
9. Program to evaluate the line integrals with constant and variable limits.
10. Program to evaluate the Double integrals with constant and variable limits.
11. Program to evaluate the Triple integrals with constant and variable limits.

Open Elective

(For students of Science stream who have not chosen Mathematics as one of the Core subjects)

MATOET2.1(A): Algebra and Partial derivatives	
Teaching Hours:3Hours/Week	**Credits:3**
Total Teaching Hours:42Hours	**Max.Marks:100 (S.A.-70+I.A.–30)**

Course Learning Outcomes: This course will enable the students to

CO1: Link the fundamental concepts of groups and symmetries of geometrical objects.
CO2: Recognize the mathematical objects called Groups. Explain the significance of the notions of Cosets, normal subgroups and factor groups.
CO3: Understand the concept of differentiation and fundamental theorem sin differentiation and various rules. Find the extreme values of functions of two variables.

UnitI: Real Number System: Recapitulation of number system. Countable and uncountable sets, standard theorems. Real line, bounded sets, suprimum and infimum of aset, completeness properties of R, Archimedean property of R. Intervals, neighborhood of a point, open sets, closed sets, limit points and Bolzano-Weierstrass theorem(Without proof). **14hours**

Unit-II: Groups: Definition of a group with examples and properties, congruence, problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's ϕ function. **14hours**

Unit-III: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives,differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin'sseries for functions of two variables, Maxima-Minima of functions of two variables. **14hours**

ReferenceBooks:

1. Topics in Algebra, I N Herstein,2nd Edition,Wiley Eastern Ltd.,New Delhi.
2. Higher algebra, Bernard &Child, Arihant Pub.
3. Modern Algebra, Sharma and Vasishta, Krishna Prakashan Mandir, Meerut,U.P
4. A Course in Abstract Algebra,Vijay K Khanna and S K Bhambri,Vikas Publications.
5. Differential Calculus, Shanti Narayan,S.Chand &Company, New Delhi.
6. Integral Calculus, Shanti Narayan and P K Mittal,S.Chand and Co.Pvt.Ltd.,
7. Schaum's Outline Series, Frank Ayres and Elliott Mendelson,5 thed. USA:Mc Graw Hill.,2008.
8. Mathematical Analysis,SCMalik,WileyEastern.
9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand &Company.