

RAJA NARENDRA LAL KHAN WOMEN'S COLLEGE (AUTONOMOUS)



**Proposed Syllabus of 4 years**  
**Bachelor of Science (Honours) in Mathematics**  
[w.e.f 2024-25]  
[under NEP-2020]

**SEMESTER-I**

Raja N.L Khan Women's College (Autonomous)  
Gope Palace, Midnapore- 721 102, West Bengal

**Semester – I**

Course Type	Course Code	Course Details		L-T-P	Credit	Marks Distribution			
						IA	CA	ESE	Total
<b>MAJOR-01</b>	<b>MTMH MJ-101</b>	<b>Group-A</b>	Calculus	3-1-0	4	10	5	60	75
		<b>Group-B</b>	Geometry						
		<b>Group-C</b>	Linear Algebra-I						
<b>SEC</b>	<b>MTM SEC-01</b>		Mathematical Logic and sets	2-1-0	3	5	5	40	50
<b>MINOR-01</b>	<b>MTM MI-101</b>	<b>Group-A</b>	Calculus	3-1-0	4	10	5	60	75
		<b>Group-B</b>	Geometry						
		<b>Group-C</b>	Linear Algebra-I						

SEC-Skill Enhancement Course, L-T-P=Lecture-Tutorial-Practical, IA-Internal Assessment; CA-Class

Attendance; ESE-End Semester Examination

## **Program Learning Outcomes of the B.Sc. Mathematics Course**

The expected outcomes of under graduate mathematics courses are summarization of disciplinary knowledge, communicative skills, critical thinking and analytical reasoning, capacity of problem solving, research related skills, digital efficiency, enhance ethical values , lifelong acquire knowledge etc.

(a) This program demonstrates fundamental systematic knowledge of mathematics .It should also enhance the subject specific knowledge and help the students in searching jobs in Government and Non-Government sectors.

(b) Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, differential calculus, geometry, ordinary differential equations, partial differential equations, numerical analysis and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps learners in building a solid foundation for higher studies in mathematics.

(c) The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilised in mathematical modelling and solving real life problems.

(d) Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

(e) Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

(f) Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools, Colleges and University.

(g) This programme will also help students to enhance their employability for government jobs like WBCS, IAS etc , jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various disciplines.

(h) This course is the gate way of entering into the premier institutes through admission test like JAM, MAT, CAT etc.

(i) One most significant outcome of the programme is the inculcation of higher values of life among the learners that enable them to face any hazard of the future life.

(j) Apply knowledge, understanding and skills to identify the difficult/unsolved problems in mathematics and to collect the required information in possible range of sources and try to analyse and evaluate these problems using appropriate methodologies.

(k) Capability to use appropriate software to solve system of equations and differential equations, basic programmes using the concept of C, C++ languages, MATLAB Coding that help in research filed.

## SEMESTER-I

### MAJOR-01

**Course Code: MTMH MJ-101**

**Course Title: Calculus, Geometry & Linear Algebra-I**

**Credit-04**

**Number of Lectures: 60 hours**

**Full Marks: 75**

**Group-A: Calculus**

Marks: 23

Unit-I : Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type  $e^{ax+b}\sin x$ ,  $e^{ax+b}\cos x$ ,  $(ax+b)^n\sin x$ ,  $(ax+b)^n\cos x$ , concavity and inflection points, curvature, envelopes, asymptotes, L'Hospital's rule ( Statement and example )

Reduction formulae, derivations and illustrations of reduction formulae of the type  $\int \sin^n x dx$ ,  $\int \cos^n x dx$ ,  $\int \tan^n x dx$ ,  $\int \sec^n x dx$ ,  $\int (\log x)^n dx$ ,  $\int \sin^n x \cos^m x dx$ , parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves

**Group-B: Analytical Geometry**

Marks: 23

Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, quadric surfaces like cone, cylinder, ellipsoid and hyperboloid.

**Group-C: Linear Algebra-I**

Marks:14

Linear dependence and independence, system of linear equations: row reduction, echelon form, rank of a matrix, solution of a system of linear equation  $Ax=b$  and its applications. Eigen values, eigen vectors and its properties, characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

#### Text Books:

- Maity & Ghosh, An Introduction to Analysis (Differential Calculus), Books and Allied Pvt Ltd
- Ghosh & Chakraborty, Analytical Geometry, U.N Dhar and Sons Pvt Ltd
- S.K.Mapa, Linear Algebra, Sarat Book Publishing House
- Maity & Ghosh, Integral Calculus, New Central Book Agency

#### Reference Books:

- G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi,2005.
- M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi,2007.
- H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
- R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
- Maity & Ghosh, An Introduction to Analysis (Differential Calculus), Books and Allied Pvt Ltd
- Maity & Ghosh, Integral Calculus, New Central Book Agency
- T. Apostol, Calculus, Volumes I and II.
- S. Goldberg, Calculus and mathematical analysis.

## Learning Outcomes of the course

After completion of the course, the student will learn the following

- (a) Tracing of curves in Cartesian and polar coordinates
- (b) nth order differentiation of hyperbolic function, trigonometric function, algebraic function and product of two functions using Leibnitz rule.
- (c) Techniques to find the area under curve, area and volume of surface of revolution, length of curve
- (d) Explain the properties and equation of three dimension shapes like sphere, cone, cylinder, ellipsoid, hyperboloid of one and two sheet, elliptic paraboloid etc
- (e) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank
- (f) Find eigenvalues and corresponding eigenvectors for a square matrix

## Skill Enhancement Course (SEC)

### MTM SEC-101: Mathematical Logic and sets

**Course Code: MTM SEC-101**

**Course Title: Mathematical Logic and Sets**

**Credit-03**

**Number of Lectures: 40 hours**

**Full Marks: 50**

#### Unit-I

Introduction: Propositions, truth table, tautology, negation, conjunction and disjunction, Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logic operators.

Propositional equivalence: Logical equivalence. Predicates and quantifiers: Introduction, quantifiers, binding variables and negations.

#### Unit-II

Sets, subsets, set operations and the laws of set theory and Venn diagrams, finite and infinite sets , cardinality of finite and infinite sets and related theorem, mathematical induction, principle of inclusion and exclusion, classes of sets, power set of a set.

#### Unit-III

Generalized union and intersections. Relation: Product set, composition of relations, equivalence relation, partitions, partial order set, lattice, modular lattice, distributive lattice, Boolean algebra, Logic Gates, DNF and CNF

## Reference Books:

R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998  
P.R. Halmos, Naïve Set Theory, Springer, 1974  
E. Kamke, Theory of Sets, Dover Publishers, 1950

## Learning Outcomes of the course

- Understanding of mathematical logic helps the students to understand ambiguity and disagreement.
- The goal of mathematical logic is to link the human language and thinking with mathematics.
- Describe the relation between sets with membership, subsets, proper subsets with proper notations
- To understand the Boolean algebra, the concepts of set theory is extensively used.

### MINOR-01

**Course Code: MTM MI-101**

**Course Title: Calculus, Geometry & Linear Algebra-I**

**Credit-04**

**Number of Lectures: 60 hours**

**Full Marks: 75**

**Group-A: Calculus**

Marks: 23

Unit-I : Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type  $e^{ax+b}\sin x$ ,  $e^{ax+b}\cos x$ ,  $(ax+b)^n\sin x$ ,  $(ax+b)^n\cos x$ , concavity and inflection points, curvature, envelopes, asymptotes, L'Hospital's rule ( Statement and example )

Reduction formulae, derivations and illustrations of reduction formulae of the type  $\int \sin^n x dx$ ,  $\int \cos^n x dx$ ,  $\int \tan^n x dx$ ,  $\int \sec^n x dx$ ,  $\int (\log x)^n dx$ ,  $\int \sin^n x \cos^m x dx$ , parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves

**Group-B: Geometry**

Marks: 23

Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, quadric surfaces like cone, cylinder, ellipsoid and hyperboloid.

**Group-C: Linear Algebra-I**

Marks: 14

Linear dependence and independence, system of linear equations: row reduction, echelon form, rank of a matrix, solution of a system of linear equation  $Ax=b$  and its applications. Eigen values, eigen vectors and its properties, characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

## Text Books:

- Maity & Ghosh, An Introduction to Analysis (Differential Calculus), Books and Allied Pvt Ltd
- Ghosh & Chakraborty, Analytical Geometry, U.N Dhar and Sons Pvt Ltd
- S.K.Mapa, Linear Algebra, Sarat Book Publishing House
- Maity & Ghosh, Integral Calculus, New Central Book Agency

## Reference Books:

- G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
- M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

- H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
- R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
- T. Apostol, Calculus, Volumes I and II.
- S. Goldberg, Calculus and mathematical analysis.

### **Learning Outcomes of the course**

After completion of the course, the student will learn the following

- (a) Tracing of curves in Cartesian and polar coordinates
- (b) nth order differentiation of hyperbolic function, trigonometric function, algebraic function and product of two functions using Leibnitz rule.
- (c) Techniques to find the area under curve, area and volume of surface of revolution, length of curve
- (d) Explain the properties and equation of three dimension shapes like sphere, cone, cylinder, ellipsoid, hyperboloid of one and two sheet, elliptic paraboloid etc
- (e) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank
- (f) Find eigenvalues and corresponding eigenvectors for a square matrix