OUTLINES OF TESTS, SYLLABI AND COURSES OF READING

for

B.Sc. Mathematics Part I (Semester I & II)

Academic Sessions
2025–26 and 2026–27

NEP-TEMPLATE FOR MULTIDISCIPLINARY UG PROGRAMME

POST GRADUATE DEPARTMENT OF MATHEMATICS
GURU NANAK COLLEGE BUDHLADA
AN AUTONOMOUS COLLEGE
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SCHEME OF THE COURSE

B.Sc. I (MATHEMATICS) SEMESTER I & II

Semester I							
Type of Course	**Course Code**	**Course Title**	**Internal**	**External**	**Practical**	**Total**	**Credit**
Major	BSMJMAT1103T	Algebra & Trigonometry	30	70	-	100	04
Minor	BSMNMAT1153T	Algebra & Trigonometry	30	70	-	100	04
SEC	BSSEMAT1128P	Mathematical based Practicals	30	-	70	100	03
IDC/MDC	BSMDMAT1129T	Quantitative Ability-I (Mathematics)	30	70	-	100	03
Semester II							
Type of Course	**Course Code**	**Name of the Paper**	**Internal**	**External**	**Practical**	**Total**	**Credit**
Major	BSMJMAT1203T	Calculus-I	30	70	-	100	04
Minor	BSMNMAT1253T	Calculus-I	30	70	-	100	04
SEC	BSSEMAT1228T	Numerical Analysis	30	35	35	100	03
IDC/MDC	BSMDMAT1229T	Quantitative Ability-II (Mathematics)	30	70	-	100	03

Rakesh Kumar Satish Bhawat Gupta

SEMESTER I
BSMJMAT1103T: ALGEBRA AND TRIGONOMETRY
(Major)

Credits: 04(L) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OBJECTIVES: To equip students with analytical techniques in trigonometry, complex functions, and matrix theory for solving mathematical and applied problems.

COURSE OUTCOMES:

1. To understand D'Moivre's Theorem and its various applications.
2. To acquire knowledge of exponential, logarithmic, direct and inverse circular, and hyperbolic functions of complex variables.
3. To understand the summation of series, including the Gregory series.
4. To know Hermitian and skew-Hermitian matrices, along with the linear dependence of row and column vectors.
5. To learn about eigenvalues, eigenvectors, and the characteristic equation of a matrix.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of Sections A and B and compulsory question of Section C.

SECTION-A

D'Moivre's theorem, Application of D'Moivre's theorem including primitive nth root of unity. Expansions of $sin\, n\theta, cos\, n\theta, sin^n\theta, cos^n\theta (n \in N)$. The exponential, logarithmic, direct and inverse circular and hyperbolic functions of a complex variable. Summation of series including Gregory Series.

SECTION-B

Hermitian and skew-hermitian matrices, linear dependence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence. Consistency of a system of linear equations (both homogeneous and non-homogeneous). Eigen-values, Eigen-vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix. Diagonalization, Quadratic forms, Quadratic form as a product of matrices.

RECOMMENDED BOOKS

1. K.B. Datta: Matrix and Linear Algebra. Prentice Hall of India Pst. Ltd., New Delhi. 2000.
2. S.R. Knight and H.S.Hall: Higher Algebra, H.M. Publications, 19994.
3. R.S. Verma and K.S. Shukla: Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayan and P.K. Mittal: A Text Book of Matrices, S. Chand & Co., New Delhi, Revised Edition, 2007.

Rakesh Kumar Bharat Gupta

SEMESTER I
BSMNMAT1153T: ALGEBRA AND TRIGONOMETRY
(Minor)

Credits: 03(L) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OUTCOMES:

6. To understand D'Moivre's Theorem and its various applications.
7. To acquire knowledge of exponential, logarithmic, direct and inverse circular, and hyperbolic functions of complex variables.
8. To understand the summation of series, including the Gregory series.
9. To know Hermitian and skew-Hermitian matrices, along with the linear dependence of row and column vectors.
10. To learn about eigenvalues, eigenvectors, and the characteristic equation of a matrix.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of Sections A and B and compulsory question of Section C.

SECTION-A

D'Moivre's theorem, Application of D'Moivre's theorem including primitive nth root of unity. Expansions of $sin\, n\theta, cos\, n\theta, sin^n\theta, cos^n\theta (n \in N)$. The exponential, logarithmic, direct and inverse circular and hyperbolic functions of a complex variable. Summation of series including Gregory Series.

SECTION-B

Hermitian and skew-hermitian matrices, linear dependence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence. Consistency of a system of linear equations (both homogeneous and non-homogeneous). Eigen-values, Eigen-vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix. Diagonalization, Quadratic forms, Quadratic form as a product of matrices.

RECOMMENDED BOOKS

5. K.B. Datta: Matrix and Linear Algebra. Prentice Hall of India Pst. Ltd., New Delhi. 2000.
6. S.R. Knight and H.S.Hall: Higher Algebra, H.M. Publications, 19994.
7. R.S. Verma and K.S. Shukla: Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahabad.
8. Shanti Narayan and P.K. Mittal: A Text Book of Matrices, S. Chand & Co., New Delhi, Revised Edition, 2007.

Rakesh Kumar

Bharat Gupta

Santosh

SEMESTER I
BSSEMAT1128P: MATHEMATICS BASED PRACTICALS
(SEC)

Credits: 03(P) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OBJECTIVES: To introduce students to fundamental concepts of functions, trigonometric functions, and coordinate geometry.

COURSE OUTCOMES:

1. The main objective of this course is to introduce students to mathematics based Softwares.
2. The students will be able to plot graphs of various functions using mathematical Softwares.
3. The students will be able to plot lines and show conics as sections of a cone.
4. They will be able to understand the basic concepts of Mathematics.
5. Students will be able to understand the applicability of Software in mathematical problems.

This laboratory course will comprise as exercises of the following topics:

SECTION-A

Functions, Domain and range of standard functions, Trigonometric functions, domain and range of trigonometric functions.

SECTION-B

Straight Lines, general equation of a line. Conic Sections, sections of a cone, circle, equation of a circle.

List of Practicals

The following Mathematics Practicals to be performed by students using Math based Free and Open Source Softwares such as Mathematica/ MATLAB/ Scilab/ Maxima/ Maple/Sage Math etc.

1. Plotting of graphs of functions:
$\sqrt{ax+b}$, $|ax+b|$, $e^{(ax+b)}$, $sin(ax+b)$, $|sin(ax+b)|$, $cos(ax+b)$, $|cos(ax+b)|$,
and observing the variation in graphs by changing values of the constants and .
2. To Plot the general equation of a straight line and explore the variation in coefficients and the constant on its geometry
3. To show conics as sections of a cone
4. To draw a circle when the Centre and radius are given.
5. To draw a circle when the Centre and any point on the circle are given.

RECOMMENDED BOOKS

1. Mathematics, A Text book for class XI, NCERT, 2021.
2. Mathematics, A Text book for class XII, NCERT (Part I and Part II),2021.

Rakesh Kumar

Satish.

Bharat Gopal

SEMESTER I
BSMDMAT1129T: QUANTITATIVE ABILITY-I
(IDC/MDC)

Credits: 03(T) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OBJECTIVES: To develop a strong foundation in number theory through concepts like divisibility, cyclicity, prime numbers, and number-theoretic functions.

COURSE OUTCOMES:

1. Able to develop logical reasoning that are necessary for building a stable career foundation.
2. Able to learn various calculations which are important in daily life
3. Able to develop numerical fluency
4. Able to develop logical thinking that assist in developing hypotheses, testing the derived hypotheses and finally drawing conclusions
5. Students will be able to learn Cognitive skills such as problem solving, decision making, critical thinking.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all, selecting two questions from each of Section A and B and compulsory questions of Section C.

SECTION-A

Number System: - Types of Real Numbers, How to find that a given number is prime or not, Divisibility rules, Cyclicity (Finding last digit and last two digits of a number), Factors, Multiples, Application of HCF and LCM. Highest power dividing a factorial, Remainders, Euler Totient function, Wilson's theorem (all theorems without proof only applications).

SECTION-B

Percentage – Relation between fraction and percentage, Change of Base, Successive percentage changes, Profit Loss and Discount, Average, Mixtures and Alligations, Word problems of average, Ratio and Proportion, Simple Interest and Compound Interest.

RECOMMENDED BOOKS

1. Quantitative Aptitude by R.S. Aggarwal, S. Chand publications
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education, India
3. Maths in Moments Quantitative Aptitude, Arihant Publications limited.

Rakesh Kumar Bhawna Goyal

SEMESTER II
BSMJMAT1203T: CALCULUS
(Major)

Credits: 04(T) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OBJECTIVES: To strengthen students' understanding of real analysis through limits, continuity, mean value theorems, and applications of derivatives.

COURSE OUTCOMES:

1. To understand the order completeness property of real numbers.
2. To learn the fundamental concepts of limits, including infinite limits and indeterminate forms.
3. To understand continuous functions, various types of discontinuities, and the continuity of composite functions.
4. To gain knowledge of Rolle's Theorem, Lagrange's Mean Value Theorem, and Cauchy's Mean Value Theorem, along with their geometric interpretations and applications.
5. To understand hyperbolic and inverse hyperbolic functions of a real variable and their derivatives.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of Sections A and B and compulsory question of Section C.

SECTION-A

Properties of real numbers:
Order property of real numbers, bounds, l.u.b. and g.l.b. order completeness property of real numbers. Archimedean property of real numbers.
Limits: $\epsilon - \delta$ definition of the limit of a function, basic properties of limits, infinite limits, indeterminate forms.
Continuity: Continuous functions, types of discontinuities, continuity of composite functions. continuity of $f(x)$, sign of a function in a neighborhood of a point of continuity, intermediate value theorem, maximum and minimum value theorem.

SECTION-B

Mean value theorems: Rolle's Theorem. Lagrange's mean value theorem. Cauchy's mean value theorem, their geometric interpretation and applications. Taylor's theorem. Maclaurin's theorem with various forms of remainders and their applications.
Hyperbolic, inverse hyperbolic functions of a real variable and their derivatives. successive differentiations. Leibnitz's theorem

Application of derivatives: Tangents and normal, Differentials and Approximations, Errors.

RECOMMENDED BOOKS

1. G.B. Thomas & R.L. Finney: Calculus and Analytic Geometry (Ninth Edition), Pearson Publication.
2. J.D. Murray & M.R. Spiegel : Theory and Problems of Advanced Calculus. Schaum's Outline Series, Schaum Publishing Co. New York.
3. P.K. Jain and S. K. Kaushik : An Introduction to Real Analysis. S. Chand & Co., New Delhi. 2000.
4. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad.
5. Shanti Narayan and P.K.Mittal: Differential Calculus, Edition 2006, S. Chand & Co., New Delhi.

SEMESTER II
BSMNMAT1253T: CALCULUS
(Minor)

Credits: 04(T) External Exam Marks: 70
Time Allowed: 3 Hrs. Internal Assessment: 30
Pass percentage: 35% Total Marks: 100

COURSE OBJECTIVES: To strengthen students' understanding of real analysis through limits, continuity, mean value theorems, and applications of derivatives.

COURSE OUTCOMES:

1. To understand the order completeness property of real numbers.
2. To learn the fundamental concepts of limits, including infinite limits and indeterminate forms.
3. To understand continuous functions, various types of discontinuities, and the continuity of composite functions.
4. To gain knowledge of Rolle's Theorem, Lagrange's Mean Value Theorem, and Cauchy's Mean Value Theorem, along with their geometric interpretations and applications.
5. To understand hyperbolic and inverse hyperbolic functions of a real variable and their derivatives.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 10 marks and Section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of Sections A and B and compulsory question of Section C.

SECTION-A

Properties of real numbers:
Order property of real numbers, bounds, l.u.b. and g.l.b. order completeness property of real numbers. Archimedean property of real numbers.
Limits: $\epsilon - \delta$ definition of the limit of a function, basic properties of limits, infinite limits, indeterminate forms.
Continuity: Continuous functions, types of discontinuities, continuity of composite functions. continuity of $f(x)$, sign of a function in a neighborhood of a point of continuity, intermediate value theorem, maximum and minimum value theorem.

SECTION-B

Mean value theorems: Rolle's Theorem. Lagrange's mean value theorem. Cauchy's mean value theorem, their geometric interpretation and applications. Taylor's theorem. Maclaurin's theorem with various forms of remainders and their applications.
Hyperbolic, inverse hyperbolic functions of a real variable and their derivatives. successive differentiations. Leibnitz's theorem

Application of derivatives: Tangents and normal, Differentials and Approximations, Errors.

RECOMMENDED BOOKS

1. G.B. Thomas & R.L. Finney: Calculus and Analytic Geometry (Ninth Edition), Pearson Publication.
2. J.D. Murray & M.R. Spiegel : Theory and Problems of Advanced Calculus. Schaum's Outline Series, Schaum Publishing Co. New York.
3. P.K. Jain and S. K. Kaushik : An Introduction to Real Analysis. S. Chand & Co., New Delhi. 2000.
4. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad.
5. Shanti Narayan and P.K.Mittal: Differential Calculus, Edition 2006, S. Chand & Co., New Delhi.

SEMESTER II
BSMNMAT1253T: CALCULUS
(SEC)

Credits: 03
Time Allowed: 3 Hrs.
Pass percentage: 35%

External Exam Marks: 70 (35+35)
Internal Assessment: 30 (15+15)
Total Marks: 100

COURSE OBJECTIVES: To introduce numerical methods for solving equations with emphasis on error analysis, numerical stability, and convergence.

COURSE OUTCOMES:

1. To develop skills to solve mathematical problems using numerical methods.
2. Students will be able to use numerical techniques to find roots of non linear equations.
3. Students will be able to analyse and estimate the errors in numerical solutions.
4. Will develop critical thinking skills to choose appropriate numerical method
5. Will use C/C++ Language to write and perform programs of Numerical Methods

The theory paper will be of 50 marks and practical paper will be of 50 marks. The practical will be conducted on the basis of the theory.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have two questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having five short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 5 marks and Section C will be of 15 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Section A and B and compulsory question of Section C

SECTION-A

Propagation of error, Numerical cancellation and computation of functions, Arithmetic Expressions, Numbers, operations and elementary functions, Numerical stability, and interval arithmetic.

SECTION-B

Linear and Non-linear equations: Bisection method, Regula falsi method, Secant method, Newton Raphson method. Rate of convergence.

List of Practicals

1. WAP to implement Bisection Method
2. WAP to implement Regula-Falsi Method
3. WAP to implement Secant Method
4. WAP to implement Newton-Raphson Method

RECOMMENDED BOOKS

1. Arnold Neumaier: Introduction to Numerical Analysis, Cambridge University Press, 2001.
2. Carl Erik Froberg: Introduction to Numerical Analysis, Edition, Addison Wesley Publishing Company, 1969.
3. Elements of Numerical Analysis: R.S. Gupta, Macmillan India Limited, 2009.

Rakesh Kumar

Bharat Gupta