DEPARTMENT OF MATHEMATICS

I Semester

Syllabus for B.Sc. Mathematics

SEP

(2024-2025)

Starting Year of Implementation: 2024-25 (I Semester)

Programme Outcomes (PO): By the end of the program the students will be able to:

PO 1	**Disciplinary Knowledge:** A bachelor's degree in mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects
PO 2	**Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real-life problems.
PO 3	**Critical thinking and analytical reasoning:** The students undergoing this programme acquire the ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO 4	**Problem Solving**: The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students' overall development and also equip them with mathematical modelling ability and problem solving skills.
PO 5	**Research related skills:** Completing this programme develops the capability of inquiring appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy**: The completion of this programme will enable the learner to use appropriate software to solve a system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: The student completing this program will develop the ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	**Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
PO 9	**Lifelong learning**: This programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
PO 10	Ability to pursue advanced studies and research in pure and applied Mathematical sciences.

ASSESSMENT

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	20%	80 %
Practical	20%	80 %

Syllabus for B.Sc. with Mathematics as one of the Major Subjects

SEMESTER – I

Theory	**Algebra-I Calculus-I & Geometry**
Teaching Hours : 04 Hours/Week	**Credits: 03**
Duration of Exam: 03 Hours	**Maximum Marks:100 (Exam 80 + IA 20)**

Course Learning Outcomes:
The overall expectation from this course is that the student builds a basic understanding on Algebra, Calculus and Geometry. The broader course outcomes are listed as follows.

At the end of this course, the student will be able to:

- Understand the concept of rank of matrix and use it to solve the system of homogeneous and non-homogeneous linear system of *'m*' equations in' *n*' variables.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
- Find Rank and also eigenvalues and corresponding eigenvectors of a matrix.
- Calculate the n^{th} derivatives of some standard functions.
- Analyzing problems on partial differentiation, Jacobians and related properties.
- Find the reduction formulae and apply Leibnitz Rule.
- Understand and identify geometrical aspects of planes, spheres, cone and cylinder in 3D.

Algebra-I

Unit I Matrices

Recapitulation of matrices, Elementary row and column transformations (operations). equivalent matrices, theorems on it.

Row reduced echelon form. Normal forms of a matrix, Rank of a matrix, problems. Homogenous and non-homogenous systems of linear equations in unknowns, Consistency Criterion - Criterion for uniqueness of solutions.

Eigenvalues and Eigenvectors of a square matrix of order 2 and 3, standard properties.

Cayley-Hamilton theorem with proof, Finding A^{-1}, A^{-2} *and* $A^2, A^3,\ A^4$. **14 Hours**

Calculus -I

Unit II Differential Calculus

Successive differentiation: An n^{th} derivative of the function $e^{ax+b}, (ax+b)^n,\ \log(ax+b),\ \sin(ax+b),\ \cos(ax+b)\ e^{ax}\sin(bx+c),\ e^{ax}\cos(bx+c)$ and problems, Leibnitz theorem with proof and its applications.

Partial differentiation- function of two and three variables- first and higher order derivatives. Homogeneous function- Euler's theorem and its extension with proof. Total derivative and differentiation of implicit function and composite function problems. Jacobian properties and problems. **14 Hours**

Integral Calculus

Unit III Integral Calculus

Recapitulation of integration, reduction formulas for $\int \sin^n x dx,\ \int \cos^n x dx,\ \int \tan^n x dx,$

$\int \cot^n x dx, \int \sec^n x dx, \int \operatorname{cosec}^n x dx, \int \sin^m x \cos^n x dx$ with definite limit problems, Differentiation under integral sign by Leibnitz rule and problems. **14 Hours**

Analytical Geometry

Unit IV Analytical Geometry 3D

Recapitulations of elements of three-dimensional geometry.

Planes: Different forms of the equation of plane with proof, Distance from a point to a plane, Angle between two planes, Bisectors of angle between two planes and related problems.

Spheres: Standard equation of sphere, Intersection of spheres, Orthogonal intersection, Tangents and Related problems.

Cone: Standard equation of right circular cone and Related problems.

Cylinder: Standard equation of right circular cylinder and Related problems. **14 Hours**

TEXT BOOKS

1. Matrices - A R Vasista, Krishna Prakashana Mandir.2018.
2. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.2015.
3. Analytical Solid Geometry - Shanti Narayan, P.K. Mittal, S. Chand & Company, New Delhi.2015.

REFERENCE BOOKS

4. University Algebra -N.S. Gopala Krishnan, New Age International (P) Limited,2018
5. Theory of Matrices - B S Vatsa, New Age International Publishers,2012.
6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd.,2019.
7. Calculus – Lipman Bers, Holt, Rinehart &Winston,1969.
8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt.Ltd., vol. I &II,2015.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th edition USA: Mc. Graw, 2008.