REVISED CURRICULUM FOR

V - VI Semester B. Sc. Mathematics

YEAR OF IMPLEMENTATION: 2026-27

TUMKUR UNIVERSITY

VISHVAVIDYANILAYA KARYALAYA,

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2026

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

Name of the Degree Program : B. Sc.
Subject : Mathematics
Year of Implementation : 2026-27

ASSESSMENT

Weightage for the Assessment (in percentage)

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

CONTENT OF COURSES FOR B. Sc. MATHEMATICS

FOR FIFTH - SIXTH SEMESTER

Semester	Course No.	Theory / Practical	Credits	Paper Title	Marks	
					S. A.	I. A.
V	MATDSCT5.1	Theory	3	Mathematics – V	80	20
	MATDSCT5.2	Theory	3	Mathematics – VI	80	20
	MATDSCP5.1	Practical	2	Theory based Lab on Mathematics – V and Mathematics - VI	40	10
	MATSEC5.1	Theory	2	Data Analysis – I	40	10
VI	MATDSCT6.1	Theory	3	Mathematics – VII	80	20
	MATDSCT6.2	Theory	3	Mathematics – VIII	80	20
	MATDSCP6.1	Practical	2	Theory based Lab on Mathematics – VII and Mathematics – VIII	40	10
	MATSEC6.1	Theory	2	Data Analysis – II	40	10

Syllabus for B. Sc. Mathematics

MATDST 5.1: Mathematics - V	
Teaching Hours: 3 Hours/Week	Credits: 3
Total Teaching Hours: 45 Hours	Max. Marks: 100 (S.A. – 80 + I.A. – 20)

Course Learning Outcomes: This course will enable the students to

- Explain the defining properties of rings, integral domains, and fields, and classify specific algebraic structures like subrings, ideals, and quotient rings.
- Formulate word problems into mathematical Linear Programming Problems (LPP) and solve them using graphical and Simplex methods.
- Analyze complex functions for analyticity using the Cauchy-Riemann equations and construct analytic functions using the Milne-Thomson method.

Unit-I: Rings, Integral Domains and Fields **15 Hours**

Rings – definition and properties of rings, Types of rings, Integral Domain, Fields, Rings of integers modulo n, Subrings, Ideals – Principal, Prime and Maximal ideals in a commutative ring – examples and standard properties following the definition, Quotient rings, Homomorphism – Properties, Fundamental Theorem of Homomorphism of Rings.

Unit-II: Linear Programming Problem (LPP) **15 Hours**

Convex and Polyhedral sets, Hyperplanes, Properties and Related Problems. Formulation of LPP, canonical and standard forms of LPP, Basic solutions, Basic feasible solutions, Reduction of feasible solution to basic feasible solution, correspondence between basic feasible solution and extreme points, Graphical method for LPP involving two variables, Simplex method for LPP involving two/three variables, Dual problem.

Unit-III: Function of a complex variable and differentiability **15 Hours**

Function of a complex variable - limit, continuity and differentiability of a complex function. Analytic function, Cauchy-Riemann equations in Cartesian and Polar forms- Necessary conditions for analyticity, Harmonic functions, Standard properties of analytic functions, Construction of analytic function when the real or imaginary part is given, Milne Thomson method.

Reference Books:

1.A Course in Abstract Algebra – V. K. Khanna and S. K. Bhambri, 5th Edition, S. Chand and Company Ltd, 2022.
2. Topics in Algebra - I. N. Herstein, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
3. Contemporary Abstract Algebra - Joseph A. Gallian, 10th Ed., CRC Press, 2020.
4. Complex Variables and Applications - J. W. Brown and R. V. Churchill, McGraw Hill Education, 2021.

5. Complex Analysis - L.V.Ahlfors,3rdEdition,McGrawHill, 2021.
6. Foundation of Complex Analysis – S. Ponnuswamy, Alpha Edition, Narosa Publishing House, 2015.
7. Introduction to Operations Research – F. S. Hillier, G. J. Leiberman, 11th Edition, McGraw Hill, 2021.
8. Linear Programming and Game Theory - J.G. Chakraborty and P. R. Ghosh, Moulik Library.
9. Operations Research – R. Panneerselvam, 3rd Edition, PHI Learning Pvt. Ltd., 2023.

MATDST 5.2: Mathematics - VI	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 45 Hours	**Max. Marks: 100 (S.A. – 80 + I.A. – 20)**

Course Learning Outcomes: This course will enable the students to

- Analyze the impact of truncation, rounding, and significant digits on numerical approximations, and use Taylor series to estimate calculation errors.
- Apply different numerical methods to approximate roots of transcendental equations and systems of non-linear equations.
- Solve large systems of linear equations using direct decomposition and iterative methods and evaluate matrix spectra using Rayleigh's power method.
- Formulate solutions to complex counting problems using combinatorial principles, and calculate the likelihood of real-world events using conditional probability and Bayes' Theorem.

Unit-I: Numerical Solution to Algebraic and Transcendental Equations and system of non-linear equations **15 Hours**

Errors – Significant digits, absolute, relative, percentage errors, rounding off and truncation errors (meanings and related problems), Taylor series approximations (problems only), Solutions to algebraic and transcendental equations – Bisection method, Regula-Falsi method, iterative method, Newton-Raphson method and secant method, Newton-Raphson method to solve a system of non-linear equations (Plain discussion of the rationale behind techniques and problems on their applications).

Unit-II: Numerical Solution to Systems of Linear Equations and Eigenvalue Problems **15 Hours**

Direct Methods – Gauss elimination method, Gauss-Jordan elimination method and LU decomposition methods – Crout's, Doolittle's and Cholesky's methods, Iterative methods – Gauss-Jacobi method, Gauss-Seidel method, Successive-Over Relaxation method (SOR) method, Rayleigh's power method to find the numerically largest eigenvalue of a matrix.

Unit-III: Counting Principles and Basics of Probability **15 Hours**

Recapitulation of basics of Set Theory, Principles of Counting - Sum and Product rule, Permutations and Combinations, Binomial Theorem, Combinations with repetition. Introduction to Probability, Axioms of Probability, Rules of Probability, Conditional

Probability, Total Probability, Independent events, Baye's theorem and related problems.

Reference Books:

1. Introductory methods of Numerical Analysis - S. S. Sastry, 5thEdition, PHI Learning Private Limited.
2. Numerical Methods: For Scientific and Engineering Computation - M. K. Jain, S. R. K. Iyengar and R. K. Jain, , 8th Edition, New Age International, 2022.
3. Numerical Methods for Scientists and Engineers - B. S. Grewal, Khanna Publishers.
4. Probability and statistics for science and Engineering - G.Shankar Rao, Universities Press(India) Private Ltd., 2011.
5. Probability and Statistics - J. Schiller, M. R. Spiegel and R. A. Srinivasan, Schaum's Outline Series, 2020.

MATDSCP5.1: Theory based Lab on Mathematics - V and VI using Maxima	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A. – 40 + I.A. – 10)

Practical/Lab Work to be performed in Computer Lab:

1. Finding a real root of an algebraic/transcendental equation by bisection method.
2. Finding a real root of an algebraic/transcendental equation by regula-falsi method.
3. Finding a real root of an algebraic/transcendental equation by Newton-Raphson method.
4. Solving a system of linear equations by the method of Gaussian elimination.
5. Solving a system of linear equations by Gauss-Jacobi iterative method.
6. Solving a system of linear equations by Gauss-Seidel iterative method.
7. Solving a system of linear equations by SOR method.
8. Finding the numerically largest eigenvalue of a square matrix by Rayleigh's power method.
9. Verifying a ring to be (i) commutative (ii) with/without unity.
10. Verifying a ring to be an integral domain/field.
11. Verifying Cauchy-Riemann equations in Cartesian form and polar form.
12. Constructing analytic functions using Milne-Thomson method.
13. Illustrating orthogonality of surfaces obtained from the real and imaginary parts of an analytic function.
14. Verifying harmonicity of the real and imaginary parts of an analytic function.

Skill Enhancement Course (SEC) in Mathematics for Fifth Semester B. Sc.

MATSEC 5.1: Data Analysis - I	
Teaching Hours : 1 Hour/Week Practical Hours: 2 Hours/Week	Credits: 2
Total Teaching Hours: Theory : 15 Hours, Practical : 30 Hours	Max. Marks: 50 (S.A.-40 + I.A.-10)

Course Learning Outcomes: This course will enable the students to:

- Learn the fundamentals of mathematical statistics.
- Learn the applications of statistics in the field of data analysis.
- Learn using Microsoft Excel to perform statistical calculations.

Introduction to Excel, Data classification and analysis **15 hours**

Introduction to Microsoft Excel – Basic features, Worksheet, Workbook, Basic operations, Functions in Excel.

Collection, Classification and Tabulation of data, Bar diagrams and Pie diagrams, Histogram, Frequency curve and frequency polygon.

Measures of central tendency – Mean, Median, Mode and the relation between them, Related problems.

Reference Books:

1. Fundamentals of Statistics - S. C. Gupta, Himalaya Publishing House, 2018.
2. Mathematical Statistics - J. N. Kapur and H. C. Saxena, S. Chand Publishers, 2015.
3. Statistics, D. Freedman - R. Pisani and R. Purves, Viva Books.
4. Probability and Statistics - J. Schiller, M. R. Spiegel and R. A. Srinivasan, Schaum's Outline Series, 2020.

Lab component: Descriptive Statistics using Microsoft Excel/Libre Office

1. Introduction to some of the basic components/features of Excel.
2. Basic operations in Excel and formatting.
3. Using basic functions and formulae - I.
4. Using basic functions and formulae - II.
5. Data handling – sorting and creating filters.
6. Data handling – advanced filters.
7. Plotting Bar charts and Pie charts.
8. Finding the mean, median and mode of the given data.

MATDST 6.1: Mathematics - VII	
Teaching Hours: 3 Hours/Week	Credits: 3
Total Teaching Hours: 45 Hours	Max. Marks: 100 (S.A. – 80 + I.A. – 20)

Course Learning Outcomes: This course will enable the students to

- Explain the fundamental structural axioms of vector spaces and subspaces, and verify whether a given subset or set of vectors exhibits linear independence, forms a basis, or spans a space.
- Analyze linear transformations by determining their rank, nullity, and kernel properties, and compute their corresponding matrix representations under different choices of ordered bases.
- Evaluate complex line integrals over specified contours by applying Cauchy's Integral Theorem, Cauchy's Integral Formula, and its generalized derivative forms.
- Synthesize deep analytic properties of complex functions to prove and apply structural results like Liouville's Theorem, Cauchy's Inequality, and the Fundamental Theorem of Algebra.

Unit-I: Vector Spaces **15 Hours**

Vector spaces - Definition, examples and properties, Subspaces - Examples, criterion for a subset to be a subspace and some properties; Linear Combination - Linear span, Linear dependence and Linear independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; Basis and dimension - Co-ordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors, Quotient spaces.

Unit-II: Linear Transformations **15 Hours**

Linear transformation - Definition, examples, equivalent criteria, some basic properties and matrix representation and change of basis and effect on associated matrix, similar matrices; Null space, Range space, Rank-nullity theorem and related problems.

Unit-III: Complex Integration **15 Hours**

Complex integration– definition, Complex Line integral - properties and problems, Cauchy's Integral theorem-proof using Green's theorem, direct consequences. Cauchy's Integral formula, Cauchy's generalized formula for derivatives and applications for evaluation of simple line integrals, Cauchy's inequality, Fundamental Theorem of Algebra, Liouville's theorem.

Reference Books:

1.A Course in Abstract Algebra – V. K. Khanna and S. K. Bhambri, 5th Edition, S. Chand and Company Ltd, 2022.

2. Topics in Algebra - I. N. Herstein, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
3. Contemporary Abstract Algebra - Joseph A. Gallian, 10th Ed., CRC Press, 2020.
4. Complex Variables and Applications - J. W. Brown and R. V. Churchill, McGraw Hill Education, 2021.
5. Complex Analysis - L.V.Ahlfors,3rd Edition, Mc Graw Hill, 2021.
6. Foundation of Complex Analysis – S. Ponnuswamy, Alpha Edition, Narosa Publishing House, 2015.

MATDST 6.2: Mathematics - VIII	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 45 Hours	**Max. Marks: 100 (S.A. – 80 + I.A. – 20)**

Course Learning Outcomes: This course will enable the students to

- Apply finite difference operators to construct polynomial interpolation models for data points at both equal and unequal intervals using different methods.
- Compute approximate first and second-order derivatives from discrete data points, and evaluate definite integrals using standard quadrature algorithms such as the Trapezoidal and Simpson's rules.
- Solve first-order initial value problems (IVPs) numerically by applying Taylor series, iterative methods, standard predictor-corrector and Runge-Kutta 4th-order methods.
- Analyze discrete and continuous random variables by computing their mathematical expectation, and use standard distributions to solve probability problems.

Unit-I: Numerical Interpolation and Differentiation **15 Hours**

Interpolation with equal intervals – Finite differences, Forward, backward and central differences and shift operators – definitions, properties and problems, Polynomial interpolation – Newton-Gregory forward and backward interpolation formulae, Interpolation with unequal intervals – Lagrange's interpolation and Newton's divided differences method.

Numerical Differentiation – General Formula based on Newton-Gregory forward and backward interpolations, derivatives (till second order) – Derivations and problems based on them.

Unit-II: Numerical Integration and solution to first order ODE IVPs **15 Hours**

Numerical Integration – General quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Weddle's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's 1/3 rule and problems on the applications of all formulae).

Numerical solutions of first order linear differential equations IVPs– Taylor series method, Picard's method, Cauchy–Euler method, Modified Euler's method, Runge-Kutta fourth order method.

Unit-III: Random variables and Probability distributions **15 Hours**

Introduction to Random Variables – Discrete and Continuous Random Variables, Cumulative Distribution function, Probability Mass Function and Probability Density Function, Mathematical Expectation, Binomial Distribution – Mean, Variance and

related problems, Poisson Distribution (As a limiting case of Binomial Distribution) – Mean, Variance and related problems, Exponential Distribution – Mean, Variance and related problems, Normal Distribution – Normal Probability Curve, Standard Normal Distribution – Mean, Variance and related problems, Area under a standard normal curve and related problems.

Reference Books:

1. Introductory methods of Numerical Analysis - S. S. Sastry, 5thEdition, PHI Learning Private Limited.
2. Numerical Methods: For Scientific and Engineering Computation - M. K. Jain, S. R. K. Iyengar and R. K. Jain, , 8th Edition, New Age International, 2022.
3. Numerical Methods for Scientists and Engineers - B. S. Grewal, Khanna Publishers.
4. Probability and statistics for science and Engineering - G. Shankar Rao, Universities Press(India) Private Ltd., 2011.
5. Probability and Statistics - J. Schiller, M. R. Spiegel and R. A. Srinivasan, Schaum's Outline Series, 2020.

MATDSCP6.1: Theory based Lab on Mathematics - VII and VIII using Maxima	
Teaching Hours : 4 Hours/Week	Credits: 2
Total Teaching Hours: 60 Hours	Max. Marks: 50 (S.A. – 40 + I.A. – 10)

Practical/Lab Work to be performed in Computer Lab:

1. Finding the nth differences of polynomial.
2. Performing Newton-Gregory forward and backward interpolation.
3. Finding the interpolating polynomial using Lagrange's interpolation method.
4. Evaluating definite integrals using trapezoidal rule.
5. Evaluating definite integrals using Simpson's 1/3 rule.
6. Evaluating definite integrals using Simpson's 3/8 rule.
7. Evaluating definite integrals using Weddle's rule.
8. Solving an ODE IVP by modified Euler's method.
9. Solving an ODE IVP by Runge-Kutta fourth order method.
10. Expressing a vector as a linear combination of the given set of vectors.
11. Verifying linear dependence and independence of a set of vectors.
12. Finding the basis and dimension of a vector space.
13. Evaluating a complex line integral – basic problems.
14. Verifying Cauchy's integral theorem.

Skill Enhancement Course (SEC) in Mathematics for Sixth Semester B. Sc.

MATSEC 6.1: Data Analysis - II	
Teaching Hours : 1 Hour/Week Practical Hours: 2 Hours/Week	Credits: 2
Total Teaching Hours: Theory : 15 Hours, Practical : 30 Hours	Max. Marks: 50 (S.A.-40* + I.A.-10)

Course Learning Outcomes: This course will enable the students to:

- Learn the fundamentals of mathematical statistics.
- Learn the applications of statistics in the field of data analysis.
- Learn using Python to perform statistical calculations.

Measures of Dispersion and Symmetry **15 hours**

Mean deviation, Standard deviation, Skewness, Kurtosis, Introduction to Bivariate data - Relation between two variables, Scatter diagram, Correlation - Karl Pearson's coefficient of correlation.

Linear and non-linear regression – Lines of regression, Coefficients of regression, Curve fitting by the method of least squares - fitting a straight line $y=ax+b$ and a parabola $y= ax^2+bx+c$.

Reference Books:

1. Fundamentals of Statistics - S. C. Gupta, Himalaya Publishing House, 2018.
2. Mathematical Statistics - J. N. Kapur and H. C. Saxena, S. Chand Publishers, 2015.
3. Statistics - D. Freedman, R. Pisani and R. Purves, Viva Books.
4. Probability and Statistics - J. Schiller, M. R. Spiegel and R. A. Srinivasan, Schaum's Outline Series, 2020.

Lab component: Descriptive Statistics using Python

1. Introduction to Python.
2. Basic operations in Python.
3. Conditional statemens in Python.
4. Finding the standard deviation, skewness and kurtosis.
5. Finding the Karl Pearson's coefficient of correlation.
6. Finding the coefficients of regression.
7. Fitting the line of best fit using the method of least squares.
8. Fitting the parabola of best fit using the method of least squares.

Blueprint for DSCT

Question Paper Pattern for DSCT (V and VI semester)

(S.A. - 80 + I.A. - 20)

Duration: 03 hours **Max. Marks: 80**

PART- A	
Answer any 10 questions of the given 12 questions	10 X 2 = 20
Question Numbers – 1 to 12	
PART- B	
Answer any 10 questions of the given 12 questions	10 X 3 = 30
Question Numbers –13 to 24	
PART – C	
Answer any 5 questions of the given 6 questions	5 X 6 = 30
Question Numbers –25 to 30	

Note: The question paper shall strictly adhere to the following blueprint.

Unit	Unit 1	Unit 2	Unit 3
PART- A	04 Questions	04 Questions	04 Questions
PART- B	04 Questions	04 Questions	04 Questions
PART- C	02 Questions	02 Questions	02 Questions

Blueprint for SEC

Question Paper Pattern for SEC (V and VI semester)

(S.A. - 40 + I.A. - 10)

Duration: 1 ½ hours **Max. Marks: 40**

PART- A	
Answer any 3 questions of the given 4 questions	3 X 2 = 6
Question Numbers – 1 to 4	
PART- B	
Answer any 3 questions of the given 4 questions	3 X 3 = 9
Question Numbers –5 to 8	
PART – C	
Answer any 3 questions of the given 4 questions	3 X 5 = 15
Question Numbers –9 to 12	

PART – D	
Answer any 5 questions of the given 6 questions	2 X 5 = 10
Question Numbers –13 to 18*	

Note*: Six questions, two marks each, related to the practical component should be asked in the theory examination question paper in PART – D. No separate practical examination shall be conducted.

Practical Examination Pattern for DSCP (V-VI semester)
(S.A. - 40 + I.A. - 10)

Duration: 03 hours **Max. Marks: 40**

Marks Allotment	
Program writing*	10
Problem solving*	10
Program execution*	10
Viva-voce**	05
Record	05
Total	**40 marks**

Note:

*(i) A total of 3 programs should be given to each student. He/she has to write any two out of the three programs, solve the corresponding problems, write the programs and then execute them using Maxima.

**(ii) Viva-voce examination should be conducted based on the syllabus for the corresponding semester.