

**YOGI VEMANA UNIVERSITY**  
**UG CBCS**  
**B.A. / B.Sc. MATHEMATICS COURSE STRUCTURE**

Year	Semester	Paper	Subject	Hrs	Credits	IA	EA	Total
<b>1</b>	<b>I</b>	<b>I</b>	Differential Equations	6	5	25	75	100
	<b>II</b>	<b>II</b>	Solid Geometry	6	5	25	75	100
<b>2</b>	<b>III</b>	<b>III</b>	Abstract Algebra	6	5	25	75	100
	<b>IV</b>	<b>IV</b>	Real Analysis	6	5	25	75	100
<b>3</b>	<b>V</b>	<b>V</b>	Ring Theory & Vector Calculus	5	5	25	75	100
		<b>VI</b>	Laplace Transforms	5	5	25	75	100
	<b>VI</b>	<b>VII</b>	Linear Algebra - I	5	5	25	75	100
		<b>VIII</b>	<b>Cluster Elective:</b> VIII-A1: Integral Transforms VIII-A2: Numerical Analysis VIII-A3: Linear Algebra - II	5	5	25	75	100
				5	5	25	75	100
				5	5	25	75	100
				5	5	25	75	100

B.A./B.Sc. MATHEMATICS SYLLABUS  
SEMESTER –I  
PAPER – I : DIFFERENTIAL EQUATIONS

60 Hrs

**UNIT – I (12 Hours), Differential Equations of first order and first degree :**

Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors; Change of Variables.

**UNIT – II (12 Hours), Orthogonal Trajectories.**

**Differential Equations of first order but not of the first degree :**

Equations solvable for  $p$ ; Equations solvable for  $y$ ; Equations solvable for  $x$ ; Equations that do not contain  $x$  (or  $y$ ); Equations of the first degree in  $x$  and  $y$  – Clairaut's Equation.

**UNIT – III (12 Hours), Higher order linear differential equations-I :**

Solution of homogeneous linear differential equations of order  $n$  with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

General Solution of  $f(D)y=0$

General Solution of  $f(D)y=Q$  when  $Q$  is a function of  $x$ .

$\frac{1}{f(D)}$  is Expressed as partial fractions.

P.I. of  $f(D)y = Q$  when  $Q = be^{ax}$

P.I. of  $f(D)y = Q$  when  $Q$  is  $b \sin ax$  or  $b \cos ax$ .

**UNIT – IV (12 Hours), Higher order linear differential equations-II :**

Solution of the non-homogeneous linear differential equations with constant coefficients.

P.I. of  $f(D)y = Q$  when  $Q = bx^k$

P.I. of  $f(D)y = Q$  when  $Q = e^{ax} V$

P.I. of  $f(D)y = Q$  when  $Q = xV$

P.I. of  $f(D)y = Q$  when  $Q = x^m V$

**UNIT – V (12 Hours), Higher order linear differential equations-III :**

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation.

**Reference Books :**

1. Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Learning Pvt. Ltd. New Delhi-Second edition.
2. A text book of mathematics for BA/BSc Vol 1 by N. Krishna Murthy & others, published by S. Chand & Company, New Delhi.
3. Ordinary and Partial Differential Equations Raisinghanian, published by S. Chand & Company, New Delhi.
4. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-universities press.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Application of Differential Equations in Real life

B.A./B.Sc. MATHEMATICS SYLLABUS  
**SEMESTER – II**  
**PAPER – II : SOLID GEOMETRY**

**60 Hrs**

**UNIT – I (12 hrs) : The Plane :**

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

**UNIT – II (12 hrs) : The Line :**

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line;

**UNIT – III (12 hrs) : Sphere :**

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;

**UNIT – IV (12 hrs) : Sphere & Cones :**

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified form of the equation of two spheres.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; Enveloping cone of a sphere; Equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone; Condition that a cone may have three mutually perpendicular generators;

**UNIT – V (12 hrs) Cones & Cylinders :**

Intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex; Right circular cone; Equation of the right circular cone with a given vertex; axis and semi-vertical angle.

Definition of a cylinder; Equation to the cylinder whose generators intersect a given conic and are parallel to a given line; Enveloping cylinder of a sphere; The right circular cylinder; Equation of the right circular cylinder with a given axis and radius.

**Reference Books :**

1. Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, Published by S. Chand & Company Ltd. 7th Edition.
2. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, Published by S. Chand & Company, New Delhi.
3. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, Published by Wiley Eastern Ltd., 1999.
4. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Application of Solid Geometry in Engineering

B.A./B.Sc. MATHEMATICS SYLLABUS  
SEMESTER – III  
PAPER – III : ABSTRACT ALGEBRA

60 Hrs

**UNIT – 1 : (10 Hrs) GROUPS :-**

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group. Composition tables with examples.

**UNIT – 2 : (14 Hrs) SUBGROUPS :-**

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterion for a complex to be a subgroups.

Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

**Co-sets and Lagrange's Theorem :-**

Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

**UNIT –3 : (12 Hrs) NORMAL SUBGROUPS :-**

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group – simple group – quotient group – criteria for the existence of a quotient group.

**UNIT – 4 : (10 Hrs) HOMOMORPHISM :-**

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

**UNIT – 5 : (14 Hrs) PERMUTATIONS AND CYCLIC GROUPS :-**

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

**Cyclic Groups :-**

Definition of cyclic group – elementary properties – classification of cyclic groups.

**Reference Books :**

1. Abstract Algebra, by J.B. Fraleigh, Published by Narosa Publishing house.
2. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, Published by S.Chand & Company, New Delhi.
3. Modern Algebra by M.L. Khanna.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Group theory and its applications in Graphics and Medical image Analysis

**UNIT – I (12 hrs) : REAL NUMBERS & INFINITE SERIES :**

The algebraic and order properties of  $\mathbb{R}$ , Absolute value and Real line, Completeness property of  $\mathbb{R}$ , Applications of supremum property; intervals. Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. **(No. Question is to be set from this portion.)**

Introduction to series, convergence of series. Cauchy's general principle of convergence for series, tests for convergence of series, Series of Non-Negative Terms.

1. Comparison test
2. Cauchy's  $n^{\text{th}}$  root test or Root Test.
3. D'Alembert's Test or Ratio Test.
4. Alternating Series – Leibnitz Test.

**UNIT – II (12 hrs) : CONTINUITY**

**Limits :** Limits of functions. Limits at infinity.

**Continuous functions :** Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

**UNIT – III (12 hrs) : DIFFERENTIATION AND MEAN VALUE THEOREMS :**

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

**UNIT – IV (12 hrs) : RIEMANN INTEGRATION-I:**

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for  $\mathbb{R}$  – integrability, Another definition of Riemann integral, Some classes of bounded integrable functions.

**UNIT – V (12 hrs) : RIEMANN INTEGRATION-II:**

Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

**Reference Books :**

1. Real Analysis by Robert & Bartely and .D.R. Sherbart, Published by John Wiley.
2. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania Published by S. Chand & Company Pvt. Ltd., New Delhi.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Real Analysis and its applications

**Reference Books :**

1. Real Analysis by Robert & Bartely and .D.R. Sherbart, Published by John Wiley.
2. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania Published by S. Chand & Company Pvt. Ltd., New Delhi.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Real Analysis and its applications

B.A./B.Sc. MATHEMATICS SYLLABUS  
**SEMESTER – V**  
**PAPER – V : RING THEORY & VECTOR CALCULUS**

**60 Hrs**

**UNIT – 1 (12 hrs) RINGS-I**

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field.

**UNIT – 2 (12 hrs) RINGS-II**

Sub Rings, Ideals, Quotient Rings.

Definition of Homomorphism – Homomorphic Image – Elementary Properties of Homomorphism – Kernel of a Homomorphism – Fundamental theorem of Homomorphism.

**UNIT –3 (12 hrs) VECTOR DIFFERENTIATION**

Vector Differentiation, Ordinary derivatives of vectors, Differentiability, Gradient, Divergence, Curl operators, Formulae Involving these operators.

**UNIT – 4 (12 hrs) VECTOR INTEGRATION**

Line Integral, Surface Integral, Volume integral with examples.

**UNIT – 5 (12 hrs) VECTOR INTEGRATION APPLICATIONS**

Theorems of Gauss and Stokes, Green's theorem in plane and applications of these theorems.

**Reference Books :-**

1. Abstract Algebra by J. Fraleigh, Published by Narosa Publishing house.
2. Vector Calculus by Santhi Narayana, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.
4. Vector Calculus by R. Gupta, Published by Laxmi Publications.
5. Vector Calculus by P.C. Matthews, Published by Springer Verlag publications.
6. Rings and Linear Algebra by Pundir & Pundir, Published by Pragathi Prakashan.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Ring theory and its applications

B.A./B.Sc. MATHEMATICS SYLLABUS  
SEMESTER – V  
PAPER – VI : LAPLACE TRANSFORMS

60 Hrs

**UNIT – 1 (12 hrs) Laplace Transform - I**

Definition of - Integral Transform – Laplace Transform Linearity, Property, Piecewise continuous Functions, Existence of Laplace Transform, Functions of Exponential order, and of Class A.

**UNIT – 2 (12 hrs) Laplace Transform - II**

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace Transform of the derivative of  $f(t)$ , Initial Value theorem and Final Value theorem.

**UNIT – 3 (12 hrs) Laplace Transform - III**

Laplace Transform of Integrals – Multiplication by  $t$ , Multiplication by  $t^n$  – Division by  $t$ . Laplace transform of Bessel Function, Laplace Transform of Error Function, Laplace Transform of Sine and cosine integrals.

**UNIT – 4 (12 hrs) Inverse Laplace Transform - I**

Definition of Inverse Laplace Transform. Linearity, Property, First Shifting Theorem, Second Shifting Theorem, Change of Scale property, use of partial fractions, Examples.

**UNIT – 5 (12 hrs) Inverse Laplace Transform - II**

Inverse Laplace transforms of Derivatives–Inverse Laplace Transforms of Integrals – Multiplication by Powers of ‘ $P$ ’– Division by powers of ‘ $P$ ’– Convolution Definition – Convolution Theorem – proof and Applications – Heaviside’s Expansion theorem and its Applications.

**Reference Books :-**

1. Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.
3. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
4. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd., New Delhi.

**Suggested Activities:**

Seminar/ Quiz/ Assignments

B.A./B.Sc. MATHEMATICS SYLLABUS  
SEMESTER – VI  
PAPER – VII : LINEAR ALGEBRA - I

**60 Hrs**

**UNIT – I (12 hrs) : Vector Spaces - I**

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

**UNIT –II (12 hrs) : Vector Spaces - II**

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

**UNIT –III (12 hrs) : Linear Transformations**

Linear transformations, linear operators, Properties of L.T, , Determination of L.T, sum and product of L.T's Algebra of Linear Operators, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank -Nullity Theorem.

**UNIT –IV (12 hrs) : Vector Space Isomorphism**

Fundamental theorem of homomorphism, Singular and non –singular transformations, inverse function, Uniqueness of inverse.

**UNIT –V (12 hrs) : Matrix of a Linear Transformation**

Definition of Matrix of a Linear Transformation, Problems on finding the matrix of a Linear Transformation, Transition matrix and problems on transition matrix.

**Reference Books :**

1. Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut-250002.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et al published by Prentice Hall of India Pvt. Ltd. 4<sup>th</sup> Edition 2007.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on “Applications of Linear algebra Through Computer Sciences”



B.A./B.Sc. MATHEMATICS SYLLABUS  
SEMESTER – VI  
**Cluster Elective – Paper VIII - A1: INTEGRAL TRANSFORMS**

**UNIT – I (12 hrs) Application of Laplace Transform to solutions of Differential Equations : -**

Solutions of ordinary Differential Equations.  
Solutions of Differential Equations with constants co-efficient  
Solutions of Differential Equations with Variable co-efficient

**UNIT – II (12 hrs) Application of Laplace Transform : -**

Solution of simultaneous ordinary Differential Equations.  
Solutions of partial Differential Equations.

**UNIT – III (12 hrs) Application of Laplace Transforms to Integral Equations : -**

Integral Equations-Abel's, Integral Equation-Integral Equation of Convolution Type, Integro Differential Equations. Application of L.T. to Integral Equations.

**UNIT – IV (12 hrs) Fourier Transforms: -**

Definition of Fourier Transform – Fourier sine Transform – Fourier cosine Transform – Relationship between Fourier and Laplace transforms – Linear Property – Change of Scale Property – Modulation theorem – Derivative theorem – Shifting property – Convolution Theorem for Fourier transform – Problems related to Integral Equations – Parseval's Identity.

**UNIT – V (12 hrs) Fourier Series: -**

Fourier series, Fourier series in the interval  $[-\pi, \pi]$ , Fourier series in the interval  $[0, 2\pi]$ . Half range series, Fourier sine series in  $[0, \pi]$ , Fourier cosine series in  $[0, \pi]$ , Fourier series in the interval  $[-l, l]$ , Fourier series in the interval  $[0, 2l]$ , Fourier half range series in  $[0, l]$ .

**Reference Books :-**

1. Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. A Course of Mathematical Analysis by Shanthi Narayana and P.K. Mittal, Published by S. Chand and Company pvt. Ltd., New Delhi.
3. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Company Pvt. Ltd., New Delhi.
4. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
5. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S.Chand and Company pvt. Ltd., New Delhi.
6. Fourier series and Integral Transforms by Dr.S.Sreenadh, S.Ranganatham, MVSSN.Prasad, V.Ramesh Babu, S.Chand Publishers.
7. Higher Engineering Mathematics by Grewal.B.S., Khanna Publishers.

**Suggested Activities:**

Seminar/ Quiz/ Assignments

## Cluster Elective – Paper VIII – A2 : NUMERICAL ANALYSIS

60 Hrs

**UNIT- I: (12 hours)**

**Errors in Numerical computations and Solution of Algebraic and Transcendental Equations:** Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation. The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized Newton Raphson method.

**UNIT – II: (12 hours)**

**Interpolation–I :** Errors in polynomial interpolation, Finite Differences, Forward differences, Backward differences, Central Differences, Symbolic relations, Detection of errors by use of Differences Tables, Differences of a polynomial, Newton's formulae for interpolation.

**UNIT – III: (12 hours)**

**Interpolation – II :** Central Difference Interpolation Formulae, Gauss's central difference formulae, Stirling's central difference formula.

**UNIT – IV: (12 hours)**

**Interpolation – III :** Interpolation with unevenly spaced points, Lagrange's formula, Error in Lagrange's formula, Divided differences and their properties, Relation between divided differences and forward differences, Relation between divided differences and backward differences Relation between divided differences and central differences, Newton's general interpolation Formula.

**UNIT – V : (12 hours)**

**Numerical Differentiation and Integration:** Numerical differentiation, The Cubic Spline method, Numerical integration, Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule.

**Reference Books :**

1. Numerical Analysis by S.S.Sastry, published by Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition)
2. Numerical Analysis by G. Sankar Rao published by New Age International Publishers, New – Hyderabad.
3. Finite Differences and Numerical Analysis by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.
4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain.

**Suggested Activities:**

Seminar/ Quiz/ Assignments

**Cluster Elective – Paper VIII -A3 : LINEAR ALGEBRA - II**

**UNIT- I: (12 hours)**

**Rank of a Matrix :** Sub-matrix and Minors of a Matrix, Rank of a Matrix, Elementary transformations, Reduction to Normal Form, Inverse of a Matrix using elementary transformations, Echelon form.

**UNIT – II: (12 hours)**

**Linear Equations:** Consistency, System of Homogeneous Linear equations, System of Non-homogeneous Linear equations.

**UNIT – III: (12 hours)**

**Characteristic roots and Vectors of a Square Matrix:** Characteristic roots, characteristic vectors, Properties of characteristic vectors, Cayley - Hamilton Theorem, Inverse of a matrix by using Cayley - Hamilton Theorem.

**UNIT –IV (12 hrs) : Inner product space - I**

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle in Inequality, Parallelogram law.

**UNIT –V (12 hrs) : Inner product space - II**

Orthogonality, Ortho normal set, complete ortho-normal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

**Reference Books :**

1. Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut-250002.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low price edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et al published by Prentice Hall of India Pvt. Ltd. 4<sup>th</sup> Edition 2007.
4. A Text Book on Matrices by P.K.Mittal, S.Chand Co.
5. A Text Book on Matrices by A.R. Vasistha, A.K.Vasistha, Krishna Prashan Media.
6. A Text Book on Matrices by Santhi Narayan, S.Chand Co.