GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (CG)

DEPARTMENT OF MATHEMATICS

COURSE STRUCTURE& SYLLABUS-04 Years B.Sc. (Hon.) in Mathematics with Multiple Entry-Exit Options

Sem.	Course Type	Course Code	Course Name	Credit/ Hours (L-T-P)	Marks CCA	Marks ESE	Total Marks
I	Major-1	AMUATT2	Algebra and Geometry	4 (3-1-0)	30	70	100
	Minor-1		Opted from the Pool Course offered by University	4 (3-1-0)			
	Multidisciplinary-1		Opted from the Pool Course offered by University	3			
	AEC-1		Opted from the Pool Course offered by University	2			
	SEC-1		Opted from the Pool Course offered by University	3			
	VAC-1		Opted from the Pool Course offered by University	2			
	VAC-2		Opted from the Pool Course offered by University	2			
	Additional Credit Course						
			Total Credit		**20**		
II	Major-2	AMUBTT3	Calculus	4(3-1-0)	30	70	100
	Minor-2		Opted from the Pool Course offered by University	4(3-1-0)			
	Multidisciplinary-2		Opted from the Pool Course offered by University	3			
	AEC-2		Opted from the Pool Course offered by University	2			
	SEC-2		Opted from the Pool Course offered by University	3			
	VAC-1		Opted from the Pool Course offered by University	2			
	VAC-2		Opted from the Pool Course offered by University	2			
	Additional Credit Course						
			Total Credit		**20**		
The student must complete the 4 credit vocational course/ Internship during summer term to get UG Certificate if he wish to exit the program after first 2 semesters							

CCA: Continuous Comprehensive Assessment, ESE: End-Semester Examination

Minor course (MR) offered by the Department:

Sem.	Course Type	Course Code	Course Name	Credit/ Hour (L-T-P)	Marks CCA	Marks ESE	Total Marks
I	MR-1	AMUATG2	Geometry	4(3-1-0)	30	70	100
II	MR-2	AMUBTG1	Algebra and MatrixTheory	4(3-1-0)	30	70	100

Multidisciplinary course (MD) offered by the Department:

Sem.	Course Type	Course Code	Course Name	Credit/ Hour (L-T-P)	Marks CCA	Marks ESE	Total Marks
I	MD-1 (Any one)		Basics of Statistics	3(2-1-0)	30	70	100
			Introduction to Calculus	3(2-1-0)	30	70	100
II	MD-2 (Any one)		Curve Tracing	3(2-1-0)	30	70	100
			Interpolation	3(2-1-0)	30	70	100

Ability Enhancement course (AEC) offered by the Department:

Sem.	Course Type	Course Code	Course Name	Credit/Hour(L-T-P)	Marks CCA	Marks ESE	Total Marks
I	AEC-1		Set, Matrix and theory of Equations	2(2-0-0)	30	70	100
II	AEC-2		Special Function	2(2-0-0)	30	70	100

Skill Enhancement Course (SEC) offered by the Department:

Sem.	Course Type	Course Code	Course Name	Credit/Hour(L-T-P)	Marks CCA	Marks ESE	Total Marks
I	SEC-1	AMUATL3	Number System	3(2-1-0)	30	70	100
II	SEC-2	AMUBTL3	Linear Programming Problem	3(2-1-0)	30	70	100

Value Added Course (VAC) offered by the Department:

Sem.	Course Type	Course Code	Course Name	Credit/Hour (L-T-P)	Marks CCA	Marks ESE	Total Marks
I	VAC-1		Laplace Transform	2(2-0-0)	30	70	100
	VAC-2		Geometry in India-I	2(2-0-0)	30	70	100
II	VAC-3		Quantitative Techniques	2(2-1-0)	30	70	100
	VAC-4		Geometry in India-II	2(2-1-0)	30	70	100

L-Lecture, T- Tutorial, P- Practical

SEM-I

Major-1: Algebra and Geometry-Credit 4 (3-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
AMUATT2	3	1	0	4 Hours	30	70	100	4

COURSE OBJECTIVE:

1. To understand the importance of roots of real and complex polynomials and learn- various methods of obtaining roots.
2. To familiarize with relations, equivalence relations and partitions. Employ De-Moivre's theorem in a number of applications to solve numerical problems.
3. To recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix using rank. Find eigenvalues and corresponding eigenvectors for a square matrix.
4. To explain the geometry of straight line, plane and sphere.
5. To explain the properties with geometrical interpretation of three-dimensional shapes.

Theory of Equations and Complex Numbers- Elementary theorems on the roots of an equations including Cardan's method, The remainder and factor theorems, Synthetic division, Factored form of a polynomial, The Fundamental theorem of algebra, Relations between the roots and the coefficients of polynomial equations, Imaginary roots, Integral and rational roots; Polar representation of complex numbers, The nth roots of unity, De Moivre's theorem for integer and rational indices and its applications.

Relations and Basic Number Theory- Relations, Equivalence relations, Equivalence classes; Functions, Composition of functions, Inverse of a function; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, The fundamental theorem of arithmetic, Modular arithmetic and basic properties of congruences; Principles of mathematical induction and well ordering.

Row Echelon Form of Matrices and Applications- Systems of linear equations, Row reduction and echelon forms, Linear independence, The rank of a matrix and applications; Matrix operations, Determinants, The inverse of a matrix, Characterizations of invertible matrices; Applications to Computer Graphics; Eigen values and eigenvectors, Characteristic equation and Cayley Hamilton theorem.

Planes, Straight Lines and Spheres- Planes, Distance of a point from a plane, Angle between two planes, pair of planes, Bisectors of angles between two planes; Straight lines: Equations of straight lines, Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy.

Curves and Conicoids-Cone, Cylinder, Central conicoids, Tangent plane, Normal, Polar planes, and Polar lines.

Text Books:

1. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.
2. Bernard Kolman & David R. Hill (2003). Introductory Linear Algebra with Applications (7th edition). Pearson Education Pvt. Ltd. India.

Reference Books:

1. Titu Andreescu, & Dorin Andrica (2014). Complex Numbers from A to...Z. (2nd edition). Birkhäuser.
2. Robert J. T. Bell (1994). An Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd.
3. Leonard Eugene Dickson (2009). First Course in the Theory of Equations. The Project Gutenberg EBook (http://www.gutenberg.org/ebooks/29785)
4. Edgar G. Goodaire & Michael M. Parmenter (2015). Discrete Mathematics with Graph Theory (3rd edition). Pearson Education Pvt. Ltd. India.
5. David C. Lay, Steven R. Lay & Judi J. McDonald (2016). Linear Algebra and its Applications (5th edition). Pearson Education Pvt. Ltd. India. UGC D

COURSE OUTCOMES:

After completions of this course, students will be able:

CO1: To solve the polynomial equations and to apply De Moivre's theorems.

CO2: To distinguish between relation , function and tell about concepts of number theory.

CO3: To find various type of problems related with matrices, and solve system of linear equations.

CO4: To solve geometrical calculation regarding planes, straight lines, and spheres.

CO5: To identify conics with their geometrical shapes.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3					2	1	1	2	1		3
CO2	3	2	1	2					3	1	1	2	2		3
CO3	3	3	1	3					2	2	1	2	1		3
CO4	3	3	2	3					3	1	1	2	1		3
CO5	3	3	2	3					3	1	1	2	1		3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-I

Minor-1: GEOMETRY-Credit 4 (3-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
AMUATG2	3	1	----	4 Hours	30	70	100	4

COURSE OBJECTIVE:

1. To learn about fundamental idea of geometrical concept which are used frequently to understand graphical explanations.
2. To study a co-ordinate system, direction cosine, direction ratios.
3. To study about three-dimensional objects like sphere, cone cylinders etc.
4. To study about plane, straight lines and some standard surfaces.
5. To analyse characteristics and properties of 2D, 3D geometric shapes and developed mathematical arguments about geometric relationship.

Planes, Straight Lines and Spheres: Direction cosines, direction ratios, Planes: Distance of a point from a plane, Angle between two planes, pair of planes, Bisectors of angles between two planes; Straight lines: Equations of straight lines, Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy.

Curves and Conicoids: Cone, Cylinder, Central conicoids, Tangent plane, Normal, Polar planes ,and Polar lines, paraboloid.

Text Book:

1. S. L. Loney (1994). The elements of Coordinate Geometry. Macmillan India Ltd.

Reference Books:

1. Robert J.T. Bell (1994). An Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd.
2. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.

COURSE OUTCOMES:

This course will enable the students to:

CO1:- To explain the properties of one, two and three-dimensional fundamental shapes.

CO2:- To find the distance between two points on plane.

CO3:- To identify and sketch conics namely ellipse parabola and hyperbola.

CO4:-To deduce the equations such as planes, straight lines, spheres, cylinders and cone etc.

CO5:- To apply the knowledge of geometry in real life.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1							2	1	2	1
CO2	3	2	2	2	1							2	3	2	2
CO3	3	3	2	3	2							2	1	2	1
CO4	3	3	2	3	3							2	3	1	2
CO5	3	3	3	3	1							2	2	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-I

Multidisciplinary-1: BASICS OF STATISTICS - Credit 3 (2-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	1	----	3 Hours	30	70	100	3

COURSE OBJECTIVE:
This course will enable the students to:

1. Explain the basic ideas of measures of central tendency, dispersion and their applications.
2. Adapt the knowledge of various Probability distributions and their applications.
3. Apply statistical techniques for sampling of big data.
4. Explain a formulation helping to predict one variable in terms of the other that I, correlation and linear regression.

Frequency Distribution, Measures of Central Tendency (Mean, Median and Mode), Measure of dispersion.

Basics of Probability, Sample Space Probability, Additional and Multiplication theorems Conditional Probability, Random Variables, Expected Value, Probability Distributions, Binomial Distribution, Poission Distribution and Normal Distribution.

Correlation and Regression: Correlation Karl Pearson's Coefficient of correlation, Rank correlation, linear regression, Lines of regression. Inferences concerning the regression coefficients.

Text Books:

1. S. C. Gupta and V. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Son's, New Delhi.
2. Irwin Miller &Marylees Miller (2014). *John E. Freund's Mathematical Statistics with Applications*(8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India. Jim Pitman (1993). *Probability*, Springer-Verlag.

Reference Books:

3. Robert V. Hogg, Joseph W. McKean & Allen T. Craig(2013), Introduction to Mathematical Statistics(7th Edition), Person Education.
4. Sheldon M. Ross (2014). *Introduction to Probability Models* (11th edition).Elsevier.
5. A. M. Yaglom and I. M. Yaglom (1983). *Probability and Information*. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

COURSE OUTCOMES: This course will enable the students to:

CO1: Basic idea's of statistics and probability.

CO2: Find the correlation with real life examples.

CO3: Identify Mean, Median and Mode with example real life .

CO4: Expanded the probability, binomial and normal distribution etc.

CO5: Apply the knowledge of probability in real life.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	1							2	1	2	1
CO2	3	2	2	2	1							2	3	1	2
CO3	1	3	2	3	2							1	1	2	1
CO4	3	2	3	3	3							2	3	3	2
CO5	1	3	2	3	1							1	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-I

Multidisciplinary-1: INTRODUCTION TO CALCULUS - Credit 3 (2-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	1	----	3 Hours	30	70	100	3

COURSE OBJECTIVE: This course will enable the students to:

1. Explain the basic ideas of differential and integral and their applications.
2. Adapt the knowledge of various calculus and their applications.
3. Application of curvature , curve tracing etc.
4. Explain a formulation helping to predict one variable in terms of the other that I, Theorems and series.

Limit and Continuity: Types of discontinuities, Differentiability of functions, n^{th} Derivative, Successive differentiation, Leibniz rule and its applications.

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves, parametric representation of curves and tracing of parametric curves. Polar coordinates and tracing of curves in polar coordinates.

Rolle's theorem, Mean Value theorems, Taylor's series, Maclaurin's series of $sinx$, $cosx$, e^x, $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Text Books:

1. Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Company, New Delhi.
2. S. C. Mallik, Mathematical Analysis, Wiley Eastern Ltd, New Delhi.

Reference Books:

1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, New York 1975.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 1999.
3. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
4. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.

COURSE OUTCOMES:

This course will enable the students to:

CO1: Explain the properties of limit continuity with examples.

CO2: Find the differentiability of the function.

CO3: Find the tangent and normal etc. with real life applications.

CO4: Explain the polar coordinates and tracing of curves in polar coordinates etc.

CO5: Apply the knowledge of calculus in real life.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1							2	1	2	1
CO2	3	2	2	2	1							2	3	2	2
CO3	1	3	2	1	2							2	1	2	1
CO4	2	3	2	3	3							1	2	3	2
CO5	2	3	2	3	2							2	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-I

AEC-1: SET, MATRIX AND THEORY OF EQUATIONS- Credit 2 (2-0-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	---	----	2 Hours	30	70	100	2

COURSE OBJECTIVE:

1. To understand the concept of Cartesian product of two sets, relation, and mapping.
2. To find the root of polynomial equation, the relation between roots and coefficients of a polynomial equation.
3. To understand the properties of determinant and to solve the problems of determinants of second and third order.
4. To understand different properties of matrices and computing inverse of a matrix.
5. To find eigenvalue and eigenvector of a matrix.

Basic Set Theoretic Concepts: Definition of set, Subsets of a set, Union of Sets, Intersection of sets, Cartesian product of two sets, Function or Mappings, Binary operation, Relations, Equivalence relations.

Theory of Equations: Polynomial, Algebraic and transcendental equation, General Properties of equations, Relation between roots and coefficients, Transformation of equations, Reciprocal equation.

Determinants: Determinant of second and third order, Cofactors, Laplace expansion, Properties of determinant, row and column operations.

Matrices: Definition of matrices, Special matrices, Matrix row and column operations, Related matrix-Transpose and inverse of matrix, Equivalent matrix, Gauss Jordan method to find inverse, Normal form of matrices, Rank of Matrix, Solution of linear equations, Linearly independent and dependent sets of vectors, Eigen value and Eigen vector, properties of Eigen value, Cayley-Hamilton Theorem with application.

Text Books:

1. A. R. Vasishtha, Modern Algebra, Krishna Educational Publisher.
2. B. S. Grewal, Engineering Mathematics, Khanna Publishers.

COURSE OUTCOMES:

After completion of this course students will be able to

CO1: solve problem on relation and mapping.

CO2: find roots of a polynomial equation and also the relation between roots and coefficients of a polynomial equation.

CO3: basic operations on determinants.

CO4: find rank, eigenvalues and eigenvectors of matrices.

CO5: solve system of linear equations.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1							2	1	2	1
CO2	2	3	2	2	1							2	3	2	2
CO3	3	1	2	3	2							2	1	2	1
CO4	3	3	3	3	3							2	1	3	2
CO5	3	3	3	3	3							2	3	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-I

SEC-1: NUMBER SYSTEM – Credit 3 (2-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
AMUATL3	2	1	----	3 Hours	30	70	100	3

COURSE OBJECTIVE:

1. To aware the students about number system.
2. To develop understanding of history of number systems
3. To understand fundamentals of number systems.
4. To understand the importance of number systems in real life.

Preliminaries: Historical aspects of natural numbers, rational numbers, real number, classifications, Early Number Theory, The division algorithm, the greatest common divisor, the Euclidean algorithm, the Diophantine $ax+by=c$.

Prime Numbers – History and mathematics of Prime Numbers.

Finonacci Number: Fibonacci, the Fibonacci sequence, certain identities involving Fibonacci numbers

Text Book:

1. D. M. Burton (1994). Elementary Number Theory. McGraw Hill Higher Education

Reference Books:

1. Boyer, C.B. "Fundamental Steps in the Development of Numeration", Isis, 35, 157–158.
2. Nikolai Weibull, An Historical Survey of Number Systems, http://www.math.chalmers.se/Math/Grundutb/GU/MAN250/S04/Number_Systems.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to:

CO1: interpret basic concepts of Number systems

CO2: demonstrate knowledge of division algorithm

CO3: demonstrate knowledge of prime number and history of number systems

CO4: determine and interpret certain identities involving Fibonacci numbers and its uses

Course Outcomes and their mapping with Programme Outcomes

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	1	-	2	2	2	1	3	3	1	2
CO2	2	3	2	1	-	1	-	2	2	2	-	3	3	1	2
CO3	1	1	2	1	-	1	-	1	1	1	-	3	3	-	2
CO4	1	1	1	-	-	-	-	-	1	1	-	3	3	-	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-I

VAC-1: LAPLACE TRANSFORM - Credit 2 (2-0-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	0	----	2 Hours	30	70	100	2

COURSE OBJECTIVE: To familiarize student with the use quantitative techniques in managerial decision making.

1. To understanding and applying the Laplace transform to basic elementary function.
2. To Understanding the rules and techniques for applying Laplace transforms to functions involving multiplication and division by variables.
3. To understand demonstrating the ability to apply the change of scale property to simplify.
4. To ability to compute the Laplace transformation of periodic functions.
5. To understand the finding the inverse Laplace transformation to recover the original function from its Laplace transform.

Laplace transform: Definition of Laplace transformation, change of scale property, Laplace transform of derivatives, Laplace transform of the integral of a function, multiplication by variable, division by variable, t-shifting,

Dirac's Delta function, Laplace transform of periodic function, inverse Laplace transform, second shifting theorem.

Text Books:

1. Murray R. Spiegel, "Laplace Transformation", Schaum's outlines edition, 1988.
2. B.S Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers.
3. Joel L. Schiff, "The Laplace Transformation: Theory and Applications", Springer

COURSE OUTCOMES: After completing the course students will be able:

CO1: To apply basic transform of basic functions.

CO2: To apply the change of scale property.

CO3: To analyse the Laplace transform operation involving multiplication and division by variable in the Laplace domain.

CO4: To apply the Laplace transform of derivatives and integrals.

CO5: To apply T-shifting, Dirac's delta function, Laplace of periodic functions, inverse Laplace transform and second shifting theorem.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2										1		
CO2	3	2	2										2		
CO3	3	2	1										2		
CO4	3	2	1										2		
CO5	3	2	2										2		

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-I

VAC-2: Geometry in India-I - Credit 2 (2-0-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	0	----	2 Hours	30	70	100	2

COURSE OBJECTIVE:

1. To aware the students about Indian knowledge system.
2. To developed understanding of evolution of Mathematics in India.
3. To understand basics of ancient Indian geometry.
4. To understand the importance of lifelong learning.

General understanding of the history of geometry and mathematics in India, Different prospective on India mathematics and geometry, Geometry as a branch in Indian mathematics, Understanding the importance of circle-oriented Ness, Understanding the lack of proofs.

Sulbasutra geometry, Elementary knowledge of sulbasutras and use, Bhodhayans theorem, Determination of direction, Elementary knowledge of construction of square, rectangle and trapezia, Transformation of figures, Properties of similar figures, areas, The sulbasutras and later ages.

Mathematics in Jain and Buddhist texts, Importance/motivation to learn geometry, Value of $\sqrt{10}$, π , Trapezium and trapezoidal solids

The trapezium, Treatment by different authors (Aryabhata I, Brhmagupta, Sridhara, Mahavira) and some other Jain authors, The treatment in later authors (Aryabhata II, Sripati, Bhaskara II, Narayana Pandita).

Brahmagupta and Narayana Pandit's work on cyclic, non-cyclic quadrilaterals. Work of Parameswara for the circumradius and its proof, Application of yukti-bhasa proof for trigonometrical identities and for calculation of diagonals, area of a cyclic quadrilateral (for Brahmagupta's expressions).

Text Book:

1. T. A. Sarasvati Amma – Geometry in Ancient and Medieval India.

Reference Books:

1. Geoge Gheverghese Joseph – Indian Mathematics, World Scientific
2. Kim Plofkar – Mathematics in India (Online Version) Princeton University Press, Princeton & Oxford.

COURSE OUTCOMES:

CO1: To develop the interest of a student towards Indian knowledge system.

CO2: To understand the development of geometry in India alongside algebra and

independently of algebra.

CO3: To understand the strength of geometrical development in ancient India.

CO4: To understand certain geometrical shapes as used by ancient Indians.

CO5: Introduction of trigonometrical identities as Indian knowledge system.

Course Outcomes and their mapping with Program Outcomes

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	1	-	2	2	2	1	3	3	1	2
CO2	2	3	2	1	-	1	-	2	2	2	-	3	3	1	2
CO3	1	1	2	1	-	1	-	1	1	1	-	3	3	-	2
CO4	1	1	1	-	-	-	-	-	1	1	-	3	3	-	2
CO5	-	1	1	-	-	-	-	-	-	-	-	1	2	-	1

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-II

Major-2: CALCULUS - Credit 4 (3-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
AMUBTT3	3	1	----	4 Hours	30	70	100	4

COURSE OBJECTIVE:

1. To understand the concepts of sequences and able to assimilate the notions of limit of a sequence and convergence of a series of real numbers.
2. To calculate the limit and examine the continuity of a function at a point.
3. To understand the consequences of various mean value theorems for differentiable functions.
4. To sketch curves in Cartesian and polar coordinate systems.
5. To apply derivative tests in optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.

Sequences and Integration: Real numbers, Sequences of real numbers, Convergence of sequences and series, Definite integral as a limit of sum, Integration of irrational algebraic functions and transcendental functions, Reduction formulae, Definite integrals.

Limit and Continuity: ε-δ - definition of limit of a real valued function, Limit at infinity and infinite limits; Continuity of a real valued function, Properties of continuous functions, Intermediate value theorem, Geometrical interpretation of continuity, Types of discontinuity; Uniform continuity.

Differentiability: Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Differentiability and monotonicity, Chain rule of differentiation; Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Geometrical interpretation of mean value theorems; Successive differentiation, Leibnitz's theorem.

Expansions of Functions: Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem in finite form with Lagrange, Cauchy and Roche–Schlomilch forms of remainder; Maxima and minima.

Asymptotes and Curve Tracing: Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves.

Text Books:

1. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
2. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition). Wiley India.

Reference Books:

1. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
2. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs. Narosa.
3. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.

COURSE OUTCOMES: After completions of this course, students will be able:

CO1: To solve the sequence and series related questions and definite integral.

CO2: To check the continuity or discontinuity of function and able to find limit and use method of ε-δ.

CO3: To apply differentiable concepts to obtain maximum and minimum value of the function and various properties of differentiable functions.

CO4: To obtain expansion of functions at infinite terms.

CO5: Able to trace the curves with its various properties.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1					2	1	1	2	1		1
CO2	2	2	1	1					3	2	1	2	2		1
CO3	3	3	1	1					2	2	1	2	1		1
CO4	3	2	2	1					3	3	2	2	1		1
CO5	1	3	2	1					3	1	2	2	1		1

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-II

Minor-2: ALGEBRA AND MATRIX - Credit 4 (3-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
AMUBTG1	3	1	0	4 Hours	30	70	100	4

COURSE OBJECTIVE:

1. To study the basic concept of set, relation and function.
2. To study about the concept of group, ring, field, and their properties.
3. To solve problems that apply linear algebra to economics, physics and chemistry.
4. To define echelon and normal form of matrix.
5. To translate a system of linear equations into matrix form.

Sets, Relations, Function or mapping, injective and subjective mappings, Images and inverse images of a set under a mapping, Equivalence relation and partition, partial order relation and Zorn's lemma (without proof), Binary operations.

Group: Definition, examples, property. Subgroup, Union and intersection of groups, cyclic group, order of the group, Group of symmetries and examples, Permutation group.

Ring: Definition and examples, property, Subring, Ideal, Integral Domain.
Field: Definition and, example

Matrix algebra: Introduction, Elementary operations of matrices. Inverse of a matrix. Rank of a matrix, Echelon form of a Matix, Normal Form, Application of matrices to the system of linear equations, Consistency of the system of linear equations.

Text Book:

1. Titu Andreescu and Dorin Andrica, *Complex Numbers from A to Z*, Birkhäuser, 2006.
2. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson
3. P.R. Bhattacharya, S.K. Jain and S. R. Nagapaul Basic Abstract Algebra IInd Edition Cambridge University press Indian Edition 1997.
4. I.N.Herstein Topics in Algebra, Wiley Eastern Ltd. New Delhi 1975.

COURSE OUTCOMES: this course will enable the students to:

CO1: Explain the concept of sets, relation and function.

CO2: Draw and interpret Venn diagram.

CO3: Solve problems of group, ring and field

CO4: Solve the system of linear equations using multiple methods Gaussian elimination and matrix inversion etc.

CO5: Apply in day-to-day life when set theory, group theory and matrix theory is applicable.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1							2	1	2	1
CO2	3	2	2	2	1							2	3	2	2
CO3	3	3	2	3	2							2	1	2	1
CO4	3	3	3	3	3							2	3	3	2
CO5	3	3	3	3	3							2	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-II

Multidisciplinary-2: CURVE TRACING - Credit 3 (2-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	1	0	3 Hours	30	70	100	3

COURSE OBJECTIVE:

1. To understand the basic concept of curves in Cartesian form.
2. To examine the Asymptotes, origin, tangents to the curve at the origin, intercepts.
3. To understand the nature of curve.
4. To understand the maxima and minima, inflection point, multiple point or singular point.
5. To understand the tracing of curves in polar and parametric curves.

Introduction, curves in Cartesian form, general procedure for tracing the algebraic curve-symmetry, region, Asymptotes, origin, tangents to the curve at the origin, intercepts, sign of first and second derivative, nature of curve, maxima and minima, inflection point, multiple point or singular point,

Curve tracing of standard curves in Cartesian form, folium of Descartes, Cissoid, lemniscate of Bernoulli, Strophoid etc.

Tracing of curves in polar and parametric curves.

Text Books:

1. Gorakh Prasad (2009), Differential Calculus, Pothishala Private Limited, Allahabad.
2. B. V. Ramana (2017), Higher Engineering Mathematics, McGraw Hill Education.

Reference Books:

1. E. H. Lockwood (1961), A book of Curves, Cambridge University Press.
2. W. W. Johnson(2010), Curve Tracing in Cartesian Coordinates, Coss Press.

COURSE OUTCOMES: This course will enable the students to:

CO1: Understand basic concept of curves in Cartesian form.

CO2: It will enable the students about asymptotes, origin, tangents to the curve at the origin, intercepts.

CO3: It will enable to examine the nature of curves.

CO4: Maxima and minima, inflection point, multiple point can be derived.

CO5: Understand the concept of polar and parametric curves.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2	2	1			1			2	3	1	3
CO2	3	3		2	2	1			1			2	3	1	3
CO3	3	3		2	2	1			1			2	3	1	3
CO4	3	3		2	2	1			1			2	3	1	3
CO5	3	3		2	2	1			1			2	3	1	3

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-II

Multidisciplinary-2: INTERPOLATION - Credit 3 (2-1-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	1	0	3 Hours	30	70	100	3

COURSE OBJECTIVE:

1. To understand the Forward difference, backward difference and central difference.
2. To understand the difference of polynomial, other difference operator.
3. To understand the Newton's forward interpolation formula, Newton's backward interpolation formula.
4. To find the Central difference interpolation formula, Gauss's forward and backward interpolation formula, Sterling's and Bessel's formulae.
5. To understand the interpolation with unequal intervals.

Finite Difference: Forward difference, backward difference, central difference, difference of polynomial, other difference operator etc.

Interpolation: Introduction, Newton's forward interpolation formula, Newton's backward interpolation formula, Central difference interpolation formula, Gauss's forward and backward interpolation formula, Sterling's and Bessel's formulae.

Interpolation with unequal intervals: Lagrange's interpolation formula, divided difference, Newton's divided difference formula.

Text Books:

1. Jain M K, Iyengar S R K and Jain R K, Numerical Methods for Scientific and Engineering Computation, 4th Edn, New Age International Pvt. Ltd (2005)
2. Sastry, S S Introductory Methods of Numerical Analysis, 5th Edn. Prentice Hall of India.

Reference book:

1. Jain M K, Numerical Solutions of Differential Equations, 2nd Edn, John Wiley and Sons Ltd (1984)

Course Outcomes: This course will enable the students to:

CO1: Apply the difference operator.

CO2: Apply the difference operator on polynomial.

CO3: Formulate the forward and backward interpolation.

CO4: Understand Stirling and Bessel's formula.

CO5: Understand problems on interpolation with unequal intervals.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	2			1			2	3	1	2
CO2	3	3	1	2	3	2			1			2	3	1	2
CO3	3	3	1	2	3	2			1			2	3	1	2
CO4	3	3	1	2	3	2			1			2	3	1	2
CO5	3	3	1	2	3	2			1			2	3	1	2

Weightage:1-Slightly; 2-Moderately; 3-Strongly

SEM-II

AEC-2: SPECIAL FUNCTION - Credit 2 (2-0-0)

Sub Code	L	T	P	Duration	CCA	ESE	Total	Credits
	2	---	----	2 Hours	30	70	100	2

COURSE OBJECTIVE:

1. To learn fundamental concepts of some special functions and its applicability.
2. To understand the technique to apply Beta and Gamma function in integral calculus.
3. To understand the properties of Bessel's function and Legendre polynomial.
4. To understand orthogonality of Legendre polynomials.
5. To apply Rodrigues's formula.

Gamma function, Standard results for Gamma function, Beta function, Standard results for Beta function,

Bessel's function, Generating function, Orthogonality of Bessel's function, Recurrence relations for Bessel's function, Elementary Bessel's function,

Legendre polynomial, Rodrigues's formula, Generating function Legendre polynomial, Orthogonality of Legendre polynomials.

Text Book:

1. B. V. Ramana (2007). *Higher Engineering Mathematics,* McGraw Hill Education (India) Pvt. Ltd.

Reference Book:

1. Z. X. Wang, D. R. Guo, Zhi Xu Wang (1989), Special Functions, World Scientific Publishing Company

COURSE OUTCOMES: After completion of this course students will:

CO1: To understand the applications and the usefulness of these special functions.

CO2: To make able to solve problems of integral calculus using Beta and Gamma functions.

CO3: To know properties of Bessel's function.

CO4: To know properties of Legendre polynomials.

CO5: To apply these techniques to solve and analyze various mathematical problems.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	3	2			1			2	1	1	2
CO2	2	3	1	2	3	2			1			2	3	1	2
CO3	3	3	1	2	3	2			1			2	3	1	2
CO4	3	3	1	2	3	2			1			2	3	1	2
CO5	2	3	1	2	3	2			1			2	2	1	2

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

SEM-II

SEC-2: LINEAR PROGRAMMING - Credit 3 (2-1-0)

Course Code	L	T	P	Duration/Week	CCA	ESE	Total	Credits
AMUBTL3	2	1	0	3 Hours	30	70	100	3

COURSE OBJECTIVE: This course will enable the students:

1. To understand basic terminology & basic concepts related to linear programming problems (LPP) of real life situations.
2. To understand the few initials method for the solutions of linear programming problems.
3. To acquaint with the problem solving techniques theoretically as well as graphically.
4. To understand the duality concept of linear programming problems.
5. To tackle several parameters into account while dealing with the problem.

Linear Programming Problem, Convexity and Basic Feasible Solutions: Formulation, Canonical and standard forms, Graphical method; Convex and polyhedral sets, Hyper-planes, Extreme points; Basic solutions, Basic Feasible Solutions, Reduction of feasible solution to basic feasible solution, Correspondence between basic feasible solutions and extreme points.

Optimality criterion, improving a basic feasible solution, Unboundedness, Unique and alternate optimal solutions; Simplex algorithm and its tableau format, artificial variables, Big-*M* method.

Formulation of the dual problem, Duality theorems, Complimentary slackness theorem, Economic interpretation of the dual, Dual-simplex method.

Text Book:

1. Hamdy A. Taha (2017). Operations Research: An Introduction (10th edition) Pearson.

Reference Books:

1. Mokhtar S. Bazaraa, John J. Jarvis & Hanif D. Sherali (2010), Linear Programming and Network Flows (4th edition) John Wiley & Sons.

2. G. Hadley (2002) - Linear Programming, Narosa Publishing House.

COURSE OUTCOMES:

On satisfying the requirement of this course, students will have the knowledge and skills:

CO1: To Understand a basic thoughtfulness for linear programming problem.

CO2: To Distinguish use of different methods to various kinds of L.P.P. on the basis of type of constraints and number of variable.

CO3: To Use the simplex method to solve small linear programming models by hand.

CO4: To Understand the concept of duality in linear programming issues.

CO5: To apply LPP in Various fields such as Science, Engineering, Industry, Business, etc.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2				2		2	3	3	2	2
CO2	2	3	3	3	3				2		3	3	3	2	2
CO3	2	3	3	3	3				2		2	3	3	2	2
CO4	2	3	2	3	3				2		2	2	3	2	2
CO5	2	3	3	3	3				2		2	3	3	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-II

VAC-1: QUANTITATIVE TECHNIQUES - Credit 2 (2-0-0)

Course Code	L	T	P	Duration/Week	CCA	ESE	Total	Credits
---------	2	0	0	3 Hours	30	70	100	2

COURSE OBJECTIVE: To familiarize student with the use quantitative techniques in managerial decision making.

1. To define terms, discuss and explain the concept of quantitate technics.
2. To understand the concept of basic arithmetic mathematics problems
3. To understand the concept of simple, compound interest problems logarithms.
4. To understand basic concept and importance of matric concept.
5. To understand the solving the determinate of matric and solve the system f linear equations.

Arithmetic Ability: Numbers, HCF and LCF of numbers, decimal fractions, problems on ages, Surds and indices, percentage, profit and loss, ration and proportion partnership, chain rule, time and work, time and distance, simple and compound interest, logarithms, area, volume, surfaces area, calendar and clock problems.

Matrix: Definition of Matrices, Different Types of Matrix, Transpose of Matrices, Inverse of a Matrix, Definition of Determinants, Characteristics of Determinants, Properties of a Determinant, Solution of a System of Linear Equations Using Cramer's Rule.

Text Books:

1. Richard Bronson "Matrix Operations", Schaum's outlines edition, 1988
2. B.S Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publisher.
3. R S Agrawal, Quantative aptitude, S.Chand, Publishers.

COURSE OUTCOMES: After completing the course students will be able:

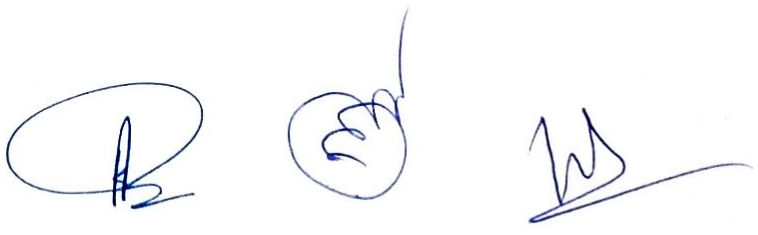
CO1: To apply logical reasoning to topics HCF, LCF and partnership problems.

CO2: To analyse and solve real-world problems involving percentages, profit and loss, time, Master basic arithmetic, decimals, and surds for problem-solving.

CO3: To apply financial calculations, profit, loss, interest, and partnership dynamics.

CO4: To solve matric operations, multiplications, determinant.

CO5: To solve linear equations by using Cramer's rule for system solutions.



Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1										1		
CO2	3	2	1										2		
CO3	2	2	1										2		
CO4	3	2	2										1		
CO5	3	2	2										1		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEM-II

VAC-2: Geometry in India-II - Credit 2 (2-0-0)

Course Code	L	T	P	Duration/Week	CCA	ESE	Total	Credits
---------	2	0	0	3 Hours	30	70	100	2

COURSE OBJECTIVE:

1. Aware the students about Indian knowledge system.
2. Develop understanding of evolution of Mathematics in India.
3. Understand basics of ancient Indian geometry.
4. Understand the importance of life long learning.

Early mention of triangle and treatment by Aryabhata, Brahmagupta, Nilakantha etc., Results on the concurrence of the perpendicular bisectors of a triangle, Square on hypotenuse, Rational rectilinear figures, the rational cyclic quadrilateral, Treatment of the rational trapezium by Narayana, Treatment of the rational right triangle by Aryabhata school.

The circle in early works, Values of π using different methods, Finding the area of a circle, the segment and the chord, Madhava's discovery of Gregory's series, The common chord and its arrows, inscribed polygons, Mutually touching circles.

Volume of the pyramid, tetrahedron, pyramid-frustum and cone-frustum, The sphere, The surface-area and volume of a sphere by integration in ancient India

Geometric algebra in the sulbasutras, work of Bhaskara II and Aryabhata school, Citrabhanu's geometrical demonstrations of algebraical identities.

Text Book:

1. T. A. Sarasvati Amma – Geometry in Ancient and Medieval India.

Reference Books:

1. Geoge Gheverghese Joseph – Indian Mathematics, World Scientific
2. Kim Plofkar – Mathematics in India (Online Version) Princeton University Press, Princeton & Oxford.

COURSE OUTCOMES:

CO1. To develop the interest of a student towards Indian knowledge system.

CO2. To understand certain geometrical shapes as used by ancient Indians.

CO3. To understand the strength of geometrical development in ancient India.

CO4. To understand the geometrical development of volume and surface area.

CO5. To Understand the development of Algebra through geometry in India.

Course Outcomes and their mapping with Programme Outcomes

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	1	-	2	2	2	1	3	3	1	2
CO2	2	3	2	1	-	1	-	2	2	2	-	3	3	1	2
CO3	1	1	2	1	-	1	-	1	1	1	-	3	3	-	2
CO4	1	1	1	-	-	-	-	-	1	1	-	3	3	-	2
CO5	-	1	1	-	-	-	-	-	-	-	-	1	2	-	1

Weightage: 1-Slightly; 2-Moderately; 3-Strongly