BON SECOURS COLLEGE FOR WOMEN(AUTONOMOUS)
Accredited with A++ Grade by NAAC in Cycle II
Affiliated to Bharathidasan University, Tiruchirappalli
UGC Recognized 2(f) and 12(B) Institution
VILAR BYPASS, THANJAVUR - 613 006, TAMIL NADU

DEPARTMENT OF MATHEMATICS

PROGRAMME : B.SC., MATHEMATICS

SYLLABUS

FIRST SEMESTER

GENERIC \ CLUSTER CORE I

DIFFERENTIAL CALCULUS & TRIGONOMETRY – 24UMS401

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit - I	CO 1	Understand the concept of a mathematical model and explain the series of steps involved in mathematical modelling.	K1 – K5
Unit - II	CO 2	Discuss features of a good model and the benefits of using a mathematical model.	K1 – K5
Unit - III	CO 3	Convert the physical problems as differential equations through mathematical modelling.	K1 – K5
Unit - IV	CO 4	Use the ideas of directed graphs, weighted digraphs and unoriented graphs for modelling real life problems.	K1 – K5
Unit - V	CO 5	Identify some simple real-life problems that can be solved using mathematical models.	K1 – K5

K1 - Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate;

SYLLABUS:

UNIT I:

Functions and Limits: Constants and variables – Functions – Classification of functions Limits.

UNIT II:

Methods of Successive Differentiation – Leibnitz's Theorem and its applications - Increasing & Decreasing functions –Maxima and Minima of functions of two variables.

UNIT III:

Curvature – Radius of curvature in Cartesian and Polar Coordinates – Centre of curvature– Radius of Curvature – Evolutes& Involutes

UNIT IV:

Expansions of $\sin(nx)$, $\cos(nx)$, $\tan(nx)$– Expansions of $\sin^n x$, $\cos^n x$ –Expansions of sin(x), cos(x), tan(x) in powers of x.

UNIT V:

Hyperbolic functions – Relation between hyperbolic & Circular functions- Inverse hyperbolic functions.

Text Books:

1. Narayanan S and Manicavachagam Pillai T.K, (2011), Calculus Volume I, S. Viswanathan (Printers & Publishers) Pvt. Limited

   UNIT – I : Chapter I Sections 1 to 10

   UNIT – II : Chapter III Sections 1.1 to 2.2,
   Chapter IV Section 2.1, 2.2 &
   Chapter V 1.1 to 1.4

   UNIT – III : Chapter X Sections 2.1 to 2.6

2. Arumugam S & others, (1999), Trigonometry and Fourier series, New Gamma Publications

   UNIT – IV : Chapter 1 Section 1.2 to 1.4

   UNIT – V : Chapter 2 Section 2.1 & 2.2

GENERIC \ CLUSTER CORE II

INTEGRAL CALCULUS – 24UMS402

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit - I	CO 1	Determine the integrals of algebraic, trigonometric and logarithmic functions and to fine the reduction formula	K1 – K5
Unit - II	CO 2	Evaluate double and triple integrals and problems using change of order of integration	K1 – K5
Unit - III	CO 3	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.	K1 – K5
Unit - IV	CO 4	Explain beta and gamma functions and to them in solving problems of integration.	K1 – K5
Unit - V	CO 5	Explain Geometric and Physical Applications of Integral Calculus.	K1 – K5

K1 - Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate;

SYLLABUS

UNIT I:

Revision of all Integral Models – Simple Problems

UNIT II:

Definite Integrals - Integration by Parts & Reduction Formula

UNIT III:

Geometric Application of Integration-Area under plane curves: Cartesian coordinates -Area of a closed curve - Examples - Areas in polar co-ordinates.

UNIT IV:

Double Integrals – changing the order of Integration – Triple Integrals.

UNIT V:

Beta & Gamma functions and the relation between them – Integration using Beta & Gamma functions

Text Book :

1. Narayanan S and Manicavachagom Pillai T.K, (2011), Calculus Volume II, S.Viswanathan (Printers & Publishers) Pvt. Limited

   UNIT I : Chapter 1 section 1 to 10

   UNIT II : Chapter 1 section 11, 12 & 13

   UNIT III : Chapter 2 section 1.1, 1.2, 1.3 & 1.4

   UNIT IV : Chapter 5 section 2.1, 2.2 & 2.4

   UNIT V : Chapter 7 section 2.1 to 2.5

SECOND SEMESTER

GENERIC \ CLUSTER CORE III

ANALYTICAL GEOMETRY 3D – 24UMS403

Course Outcome:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit - I	CO 1	Understand more about three dimension using planes	K1 – K4
Unit - II	CO 2	Learn straight lines and its symmetrical form problems using straight line	K1 – K4
Unit - III	CO 3	Study more about straight lines using coplanar and shortest distance between the lines	K1 – K4
Unit - IV	CO 4	Analyze the concepts associated with spheres and solve problems using sphere	K1 – K4
Unit - V	CO 5	Analyze more about three dimensions using cone and cylinder	K1 – K4

K1 - Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze;

SYLLABUS:

UNIT - I: PLANES

General equation –passing through three points – angle between the planes - line of intersection – length of the perpendicular – plane bisecting the angle between the Plane.

UNIT - II: STRAIGHT LINES

Symmetrical form – passing through two points – plane and straight line – Angel between the Plane and the Line.

Unit-III: STRAIGHT LINE (Contd..)

Coplanar lines – shortest distance between two lines – Intersection of three Planes.

UNIT - IV: THE SPHERE

Equation of a sphere- length of tangent to the sphere- plane section of spheres- intersection of two spheres- Tangent plane to the sphere

UNIT - V: CONE AND CYLINDER

Equation of a cone– Intersection of a straight line and a quadric cone – tangent plane and normal – Cylinder – Right circular cylinder – Equation of an Enveloping cylinder.

TEXT BOOK:

1. T.K.Manicavachagom Pillay & T. Natrajan (2012), “Analytical Geometry, part II-Three Dimensions”, Divya Subramaniyan for Ananda Book Depot, Chennai.

   Unit-I: Chapter: 2 Sec: 1 to 11
   Unit-II: Chapter: 3 Sec: 1 to 6
   Unit-III: Chapter: 3 Sec: 7 to 10
   Unit-IV: Chapter: 4 Sec: 1 to 8
   Unit-V: Chapter: 5 Sec: 1 to 5 & 8, 8.1, 8.2, 8.3.

GENERIC \ CLUSTER CORE IV

VECTOR CALCULUS AND FOURIER SERIES – 24UMS404

Course Outcome

Unit	Co	Upon completion of this course the students will be able to	Cognitive level
Unit I	CO1	Applications of the operator 'del' and to Explain soleonidal and ir-rotational vectors	K1- K4
Unit II	CO2	Solve surface integrals and volume integrals	K1 – K4
Unit III	CO3	Verify the theorems of Gauss, Stokes and Green's	K1 – K4
Unit IV	CO4	Understand the Fundamentals of Fourier Series	K1 – K4
Unit V	CO5	Solve real-world problems using half-range Fourier series	K1 – K4

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze

SYLLABUS:

UNIT I

Gradient of a vector- Directional derivative – divergence & curl of a vector solinoidal & irrotational vectors – Laplacian double operator – simple problems

UNIT II

Vector integration –Tangential line integral –Conservative force field –scalar potential- Work done by a force - Normal surface integral- Volume integral – simple problems.

UNIT III

Gauss Divergence Theorem – Stoke's Theorem- Green's Theorem – Simple problems & Verification of the theorems for simple problems.

UNIT IV

Fourier series- definition - Fourier Series expansion of periodic functions with Period 2π and period $2L$ – Use of odd & even functions in Fourier Series.

UNIT V

Half-range Fourier Series – definition- Development in Cosine series & in Sine series Change of interval.

Text books:

1. M.L.Khanna, vector calculus, jai prakash nath and co.,8^{th} edition,1986.
2. B.S.Grewal. Higher Engineering Mathematics (2002), Khanna Publishers, New Delhi.

THIRD SEMESTER

GENERIC \ CLUSTER CORE V

DIFFERENTIAL EQUATIONS & LAPLACE TRANSFORM – 24UMS405

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit-I	CO1	Solve first-order differential equations using appropriate methods such as separation of variables, integrating factor, and exact equations.	K1–K4
Unit-II	CO2	Solve second and higher-order linear differential equations using methods like undetermined coefficients, variation of parameters, and reduction of order.	K1–K4
Unit-III	CO3	Understand the formation and classification of partial differential equations and distinguish between linear, nonlinear, homogeneous, and nonhomogeneous PDEs.	K1–K4
Unit-IV	CO4	Formulate and solve first-order PDEs using methods such as Lagrange's and Charpit's methods.	K1–K4
Unit-V	CO5	Compute Laplace transforms of standard functions using basic properties.	K1–K4

K1-Remember; **K2**–Understand; **K3**–Apply; **K4**–Analyze

SYLLABUS

UNIT – I: Ordinary Differential Equation

First order, higher degree differential equations– Equations solvable for dy/dx, solvable for y, solvable for x, Clairaut's form – Homogeneous equations in x and y– simple problems.

UNIT – II: Ordinary Differential Equation

Particular integrals of second order differential equations with constant coefficients - Linear equations with variable coefficients – Method of Variation of Parameters (Omit third & higher order equations).

UNIT – III: Partial Differential Equation

Formation of Partial Differential Equation – General, Particular & Complete integrals – Solution of PDE of the standard forms - Lagrange's method - Charpit's method and few standard forms.

UNIT – IV: Partial Differential Equation

PDE of second order homogeneous equation with Constant coefficients – Particular integrals of the forms e^{ax+by}, Sin(ax+by), Cos(ax+by), $x^r y^s$ and $e^{ax+by}.f(x,y)$.

UNIT – V: Laplace Transform

Laplace Transforms – Standard formulae – Basic theorems & simple applications – Inverse Laplace Transforms – Use of Laplace Transforms in solving ODE with constant coefficients.

Text Books:

1. T.K. Manicavachagam Pillay & S. Narayanan, Differential Equations and Its Application, 4^{th}Edition (2015), Viswanathan Publishers Pvt. Ltd.

UNIT – I : Chapter IV : Sec: 1- 3.

UNIT – II : Chapter V : Sec: 1- 5, Chapter VIII : Sec: 4.

UNIT – III : Chapter XII : Sec: 1 - 6 .

UNIT – V: Chapter IX – Sec: 1 - 8

2. Arumugam & Isaac, Differential Equations and Its Application, 4th Edition (2014) New Gamma Publishing House, Palayamkottai.

UNIT – IV : Chapter V (Full)

DISCIPLINE CENTRIC CORE - I

SEQUENCES AND SERIES – 24UMA501

Course Outcome:

Unit	CO	Upon completion of this course the students will be able to	Cognitive Level
Unit – I	CO1	Understand and analyse the behaviour of different types of sequences including bounded, monotonic, convergent, divergent, and oscillating sequences.	K1 – K4
Unit – II	CO2	Apply the algebra of limits and evaluate the behaviour of monotonic functions in determining the convergence of sequences.	K1 – K4
Unit – III	CO3	Demonstrate understanding of theorems on limits, identify sub sequences and limit points, and apply the concept of Cauchy sequences to test convergence.	K1 – K4
Unit – IV	CO4	Examine the convergence of infinite series using Cauchy's general principle of convergence and apply the comparison test (statement only) to determine convergence.	K1 – K4
Unit – V	CO5	Apply the convergence of series using D' Alembert's ratio test, Cauchy's root test, and the concept of absolute convergence and alternating series	K1 – K4

K1-Remember; **K2**–Understand; **K3**–Apply; **K4**–Analyze

SYLLABUS

UNIT – I: Sets and Function

Sets and Elements – Operations on sets-Functions – Real –valued functions-Equivalence, Countability – Real Numbers – Least upper bounds

UNIT – II: Sequences of Real Numbers

Sequences – Bounded Sequences – Monotonic Sequences – Convergent Sequences – Divergent Sequences – Oscillating sequences _ Algebra of Limits – Behaviour of Monotonic functions

UNIT – III: Limits

Some theorems on limits – sub sequences – limit points – Cauchy sequences.

UNIT – IV: Infinite Series

Series – infinite series – Cauchy's general principal of convergence – Comparison – test theorem and test of convergence using comparison test (comparison test statement only, no proof).

UNIT – V: Convergence Sequence

Test of convergence using D Alembert's ratio test – Cauchy's root test – Alternating Series – Absolute Convergence (Statement only for all tests).

Text Books:

1. Richard R.Goldberg Methods of Real Analysis second Edition (1976), John Wiley & Sons, Inc

   UNIT – I : Chapter 1 Sec: 1.1 – 1.7

2. Dr. S. Arumugam & Mr. A. Thangapandi Isaac Sequences and Series, (2015)New Gamma Publishing House,

   UNIT – II : Chapter 3 Sec: 3.0 - 3.7

   UNIT – III: Chapter 3 Sec: 3.8 - 3.11

   UNIT – IV: Chapter 4 Sec: 4.1 & 4.2

   UNIT – V : Chapter 5 Sec: 5.1 & 5.2

DISCIPLINE CENTRIC CORE - II

CLASSICAL ALGEBRA AND THEORY OF NUMBERS - 24UMA502

Course Outcome:

Unit	CO	Upon completion of this course the students will be able to	Cognitive Level
Unit – I	CO1	Recognize the concepts of Relation between roots & coefficients of Polynomial Equations.	K1 – K4
Unit – II	CO2	Understand the increase or decrease the roots of an equation by a given quantity.	K1 – K4
Unit – III	CO3	Apply the Descarte's rule.	K1 – K4
Unit – IV	CO4	Illustrate the concept of Weirstrass inequalities.	K1 – K4
Unit – V	CO5	Inspect the Fermat's, Wilson's & Lagrange's Theorems.	K1 – K4

K1-Remember; **K2**–Understand; **K3**–Apply; **K4**–Analyze

SYLLABUS

UNIT – I: Theory of Equations

Relation between roots & coefficients of Polynomial – Symmetric functions – Sum of the r^{th} Powers of the Roots

UNIT – II: Theory of Equations

Newton's theorem on the sum of the power of the roots-Transformations of Equations – Diminishing, Increasing& Multiplying the roots by a constant - Reciprocal equations - Increase or decrease the roots of an equation by a given quantity.

UNIT – III: Theory of Equations

Form of the quotient and remainder – Removal of terms – Form an equation whose roots are of any power – Transformation in general – Descarte's rule of sign.

UNIT – IV: Inequalities

Inequalities – elementary principles – Geometric & Arithmetic means – Weirstrass inequalities – Cauchy inequality – Applications to Maxima & Minima.

UNIT – V: Theory of Numbers

Theory of Numbers – Prime & Composite numbers – divisors of a given number N – Euler's Function (N) and its value – The highest Power of a prime P contained in N! – Congruences – Fermat's, Wilson's & Lagrange's Theorems.

Text Books:

1. T.K.ManickavasagamPillai& others, Algebra Volume I, Revised Edition (2019) , S.V. Publications.

   UNIT – I : Chapter 6 : Section 11 to 13

   UNIT – II : Chapter 6 : Section 14 to 17

   UNIT – III : Chapter 6 : Section 18- 21 & 24

2. T.K. ManickavasagamPillai& others, Algebra Volume II, Revised Edition (2015), S.V. Publications .

UNIT – IV : Chapter 4

UNIT – V : Chapter 5

ALLIED COURSE - III

STATISTICS I – 24UMA313

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit – I	CO 1	Understand the basic concepts of statistics and measures of central tendency.	K1 – K4
Unit – II	CO 2	Calculate the measures of dispersion.	K1 – K4
Unit – III	CO 3	Draw the knowledge of basic probability and probability distribution.	K1 – K4
Unit – IV	CO 4	Calculate Moments, Cumulants, Moment generating function and various concepts of random variables.	K1 – K4
Unit – V	CO 5	Illustrate the theory of probability distribution with suitable example.	K1 – K4

K1 - Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

SYLLABUS

Unit I: Measures of Central tendency

Statistical data – Primary data and Secondary data(definitions only), Formation of frequency distribution, Measures of central tendency – mean, median, mode, geometric mean harmonic mean – simple problems – properties of above measures.

Unit II: Measures of Dispersion

Measures of dispersion – Range, quartile deviation, mean deviation, standard deviation – their coefficient, merits and demerits(simple problems) – Skewness and Kurtosis, Karlpearson's coefficients – Bowley's coefficients – simple problems.

Unit III: Probability

Probability – Definition, axiomatic approach to probability – Additive and Multiplicative laws of probability(two variables only) and conditional probability – simple problems – concept of random variables – discrete and continuous random variables – Distribution function, pmf and pdf and their properties simple problems.

Unit IV: Expectation

Mathematical Expectation – addition and multiplication theorems (two variables only) – Moment generating and characteristics functions, their properties - Conditional expectation and conditional variance(simple problems).

Unit V: Discrete Distributions

Binomial and Poisson distributions – moments, moment generating function cumulant generating function (simple problems) – fitting of Binomial and Poisson distribution.

Text Book:

1. Gupta S.C, Kapoor V.K, Fundamentals of Mathematical Statistics, Sultan Chand, 2020.

   Unit-I Chapter 1 Sec 1.2 , Chapter 2 Sec 2.2-2.9

   Unit – II Chapter 2 Sec 2.12-2.14,2.16-2.17

   Unit –III Chapter 3 Sec3. 3-3.4,3.10-3.14

   Unit – IV Chapter 6 Sec 6.2-6.4, 6.9, Chapter 7 Sec7.1,7.3

   Unit – V Chapter 8 Sec 8.4,8.5,

FOURTH SEMESTER

ALLIED COURSE - IV

24UMA314: Statistics II

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit – I	CO 1	Understand the concept, properties, and applications of the Normal Distribution and its relation to Binomial and Poisson distributions.	K1 – K4
Unit – II	CO 2	Understand and apply various sampling techniques and estimation methods to analyze data and determine sample size for specified precision.	K1 – K4
Unit – III	CO 3	Understand and apply the procedure for hypothesis testing using large sample tests in the context of sampling of variables.	K1 – K4
Unit – IV	CO 4	Apply chi-square and t-tests for statistical inference, including tests of goodness of fit, single and difference of means, and paired sample analysis.	K1 – K4
Unit – V	CO 5	Apply F-test, ANOVA, correlation, and regression analysis to study relationships between variables and interpret statistical data.	K1 – K4

Syllabus

Unit I: Discrete Distribution

Normal Distribution – Equation of normal probability curve – Standard Normal Distribution – Relation between Binomial and Normal Distributions - Relation between Poisson and Normal Distributions – Properties of Normal Distribution – Areas under Standard Normal Probability Curve – Importance of Normal Distribution.

Unit II: Sampling

Types of Sampling – Simple Random Sampling – Stratified Random Sampling – Systematic Sampling – Cluster Sampling- Multistage Sampling – Quota Sampling - Estimation Theory – Sampling Distribution of a statistic-Interval Estimation – Size of the random sample for specified precision.

Unit III: Testing of Hypothesis

Testing of Hypothesis – Procedure for testing of hypothesis – Large Sample Test _ Sampling of Variables.

Unit IV: Chi square & t test

Chi – Square test – Applications of the χ^2 – Distribution – Chi – Square test of goodness of fit – t-test for difference of means –Student's 't' distribution – Applications of t –Distribution-Test for single mean – t-test for difference of means-Paired t- test for difference of means.

Unit V: F test

F test - Analysis of Variance – One-Way Classification – Correlation Analysis – Methods of Studying Correlation- Scatter Diagram Method _ Karl Pearson's Coefficient of Correlation (Covariance Method) – Rank Correlation Method – Linear Regression Analysis –Linear and Non- linear Regression – Lines of Regression – Coefficients of Regression

Text Book:

1. Gupta, S.C. and Kapoor, V K – Fundamentals of Mathematical Statistics, Himalaya Publishing House,2022.

   Unit –I Chapter 14 Sec 14.4.1-14.4.7

   Unit- II Chapter 15 Sec 15.10-15.16, Chapter 16 Sec 16.1-16.5

   Unit-III Chapter 16 Sec 16.6, Chapter 17 Sec 17.1-17.4

   Unit-IV Chapter 18 Sec 18.1-18.4, Chapter 19 Sec 19.1-19.7

   Unit-V Chapter 23 Sec 23.1-23.4, Chapter 8 Sec 8.1-8.4,8.7, Chapter 9 Sec 9.1-9.4

DISCIPLINE CENTRIC CORE III
24UMA503: Abstract Algebra

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit-I	CO1	Understand and apply the basic concepts of groups.	K1 – K4
Unit-II	CO2	Apply Lagrange's Theorem to analyze subgroup structure.	K1 – K4
Unit-III	CO3	Analyze and construct group homomorphisms and quotient groups	K1 – K4
Unit-IV	CO4	Understand ring theory and apply properties of rings and ideals.	K1 – K4
Unit-V	CO5	Demonstrate understanding of field extensions and polynomial rings.	K1 – K4

Syllabus

UNIT – I:Groups:

Definition and Examples – Elementary Properties of a Group – Equivalent Definitions of a Group - Permutation Groups.

UNIT – II: Groups:

Subgroups – Cyclic Groups – Order of an Element – Cosets and Lagrange's Theorem.

UNIT – III: Groups:

Normal Subgroups and Quotient Groups - Isomorphism –Homomorphism.

UNIT – IV: Rings:

Definitions and Examples - Elementary properties of rings –Isomorphism - Types of rings.-Characteristic of a ring – subrings – Ideals - Quotient rings.

UNIT – V: Rings:

Maximal and Prime Ideals - Homomorphism of rings – Field of quotient of an integral domain – unique factorization domain – Euclidean domain.

Text Book:

1. S Arumugam and A. Thangapandi Isaac, Modern Algebra,Edition (2012) SciTech Publications, Chennai.

UNIT – I : Chapter 3: Sections 3.1-3.4 .

UNIT – II : Chapter 3: Sections 3.5-3.8 .

UNIT – III : Chapter 3: Sections 3.9-3.11 .

UNIT – IV : Chapter 4 :Sections 4.1-4.8 .

UNIT – V : Chapter 4 :Sections 4.9- 4.11, 4.13-4.14.

DISCIPLINE CENTRIC CORE IV
24UMA504: Graph Theory

Course Outcomes:

Unit	CO	Upon Completion of this Course the Students will be able to	Cognitive Level
Unit-I	CO1	Recognize the fundamental concepts of graphs, including types, representations, and properties.	K1 – K4
Unit-II	CO2	Understand and apply tree concepts, including spanning trees and minimum spanning trees, using algorithms such as Kruskal's and Prim's.	K1 – K4
Unit-III	CO3	Analyze properties of cut sets and their relation to fundamental circuits.	K1 – K4
Unit-IV	CO4	Identify basis vectors associated with graphs and relate them to circuit and cutset subspaces.	K1 – K4
Unit-V	CO5	Apply graph coloring techniques and compute the chromatic number and chromatic polynomial.	K1 – K4

Syllabus

UNIT I - Introduction , Paths and Circuits:

Definition of a Graph - finite & infinite graphs - incidence, degree isolated & pendent Vertices - isomorphisms -sub graphs - walks , paths & circuits - Connected & disconnected graphs - components - Euler graphs - Operations on Graphs - More on Euler graphs - Hamiltonian paths & circuits **.**

UNIT II - Trees and Fundamental Circuits:

Trees - properties of trees - pendent vertices in a tree - distances & centres in a tree - Rooted & binary trees - Spanning trees - Fundamental circuits - Finding all spanning trees of a Graph - Spanning trees in a weighted graph .

UNIT III - Cut-Sets and Cut-Vertices:

Cut sets - Properties of a Cut set - Cut sets in a graph - Fundamental circuits & Cut sets - Connectivity & separability.

UNIT IV - Vector Space of a Graph:

Vector Space of a Graph - Sets with one , two operations - modular arithmetic - Galois Fields -Vectors- Vector Spaces -Basis vectors of a graph - circuit & cutset subspaces - Orthogonal vectors & spaces.

UNIT V - Matrix representation of a graph and Coloring, Partitioning:

Matrix representation of a graph - Incidence matrix - Circuit Matrix – Fundamental Circuit Matrix and rank of the circuit matrix - Cut set matrix - adjacency matrix - Chromatic Number - Chromatic partitioning- Chromatic polynomial.

Text Book:

1. Narsingh Deo, Graph Theory with applications to Engineering & Computer Science,1st Edition (2016) Prentice Hall of India ,New Delhi.

UNIT – I -Chapter 1 section 1.1 to 1.5 & Chapter 2 Sections 2.2, 2.4 to 2.9

UNIT – II -Chapter 3 Sections 3.1 to 3.5 , 3.7 to 3.10

UNIT – III -Chapter 4 Sections 4.1 to 4.5

UNIT –IV -Chapter 6 Section 6.1 to 6.8

UNIT – V -Chapter 7 Sections 7.1 to 7.4, 7.6,7.9 and Chapter 8 Sections 8.1 to 8.3

FIFTH SEMESTER

CORE COURSE – X

24UMA505: NUMERICAL ANALYSIS

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cogniti ve Level
Unit I	CO1	Apply numerical methods to find roots of algebraic and transcendental equations.	K1 – K4
Unit II	CO2	Use interpolation techniques to estimate unknown values for equally and unequally spaced data.	K1 – K4
Unit III	CO3	Perform numerical differentiation and integration using standard formulas.	K1 – K4
Unit IV	CO4	Solve linear systems and perform matrix operations using direct and iterative methods.	K1 – K4
Unit V	CO5	Apply numerical techniques to solve ordinary differential equations effectively.	K1 – K4

K1 - Remember; K2 – Understand; K3 – Apply; K4 – Analyze;

Syllabus

UNIT – I: Algebraic & Transcendental Equations

Introduction - Bisection Method - Method of False Position - Iteration Method – Newton Raphson Method.

UNIT – II: Interpolation

Introduction - Finite differences – Newton's Formulae for Interpolation – Interpolation with Unevenly Spaced Points – Divided Differences and Their Properties. (Proof not needed).

UNIT – III: Numerical Differentiation & Integration

Introduction - Numerical Differentiation - Numerical Integration using Trapezoidal rule & Simpson's first & second rules – Euler Maclaurin Formula (Theory & Problems).

UNIT – IV: Numerical Linear Algebra

Introduction – Triangular Matrices – LU Decomposition of a Matrix – Vector and Matrix Norms – Solution of Linear Systems: Gauss Elimination Method, Gauss Jordan Method, Gauss Seidel Metod, Gauss Jacobi Metod

UNIT – V: Numerical Solution of ODE

Solution by Taylor Series Method, Picard's method, Euler's Method, Modified Euler's Method, Runge Kutta 2nd and 4th order methods (Derivation of the formula not needed) - Theory & problems using Adam's Predictor Corrector Method & Milne's Predictor Corrector Methods.

Textbook:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition (2012), PHI Learning Pvt. Ltd., New Delhi.

UNIT – I	Chapter 2	Sec: 2.1 to 2.5
UNIT – II	Chapter 3	Sec: 3.1, 3.3, 3.6, 3.9, 3.9.1, 3.10, 3.10.1
UNIT – III	Chapter 6	Sec: 6.1 to 6.5
UNIT – IV	Chapter 7	Sec: 7.1 to 7.6
UNIT – V	Chapter 8	Sec: 8.1 to 8.6

CORE COURSE – XI

24UMA506: REAL ANALYSIS

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Understand and apply the properties of the real number system, including boundedness, supremum, infimum, and the structure of sets in $\mathbb{R}$.	K1 – K4
Unit II	CO2	Evaluate limits and continuity of functions using formal definitions and apply related theorems.	K1 – K4
Unit III	CO3	Apply concepts of uniform continuity and differentiation and use major theorems to analyze functions.	K1 – K4
Unit IV	CO4	Understand and apply the concept of Riemann integration and its properties to evaluate integrals.	K1 – K4
Unit V	CO5	Analyze the difference between Pointwise and uniform convergence and their implications on continuity.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

Unit I: Real Number System

Algebraic properties of $\mathbb{R}$, Absolute value and the real line, bounded and unbounded sets, Supremum and infimum of subsets of $\mathbb{R}$, Completeness property of $\mathbb{R}$, Archimedean property, Dense property of rational numbers, Neighborhood of a point in $\mathbb{R}$, Open and closed sets in $\mathbb{R}$.

Unit II: Limit

Limits and continuity of functions Cluster/Limit point, Limit of functions ($\epsilon - \delta$ approach), sequential criterion for limits, Divergence criterion, limit theorems, infinite limits, limits at infinity, Continuity, Algebra of continuous functions, the maximum-minimum theorem.

Unit III: Differentiation

Uniform continuity of functions and Differentiation Uniform continuity, Lipschitz function, Differentiability of functions, Algebra of differentiable functions, Rolle's theorem, Mean value theorem, intermediate value property of derivatives, L'Hospital's rules, Taylors Theorem.

Unit IV: Riemann Integral

Riemann Integration: Tagged partition, Riemann sums and Riemann integral, Fundamental Theorems, Darboux Integral.

Unit V: Sequences of Functions

Pointwise and Uniform Convergence Interchange of Limits the Exponential and Logarithmic Functions the Trigonometric Functions.

Textbook:

1. Bartle, Robert G., Sherbert Donald R, Introduction to Real Analysis, 4th Edition (2018), Wiley India Pvt. Ltd.

Unit I: Chapter 2 Sec: 2.1 to 2.5

Unit II: Chapter 4 Sec: 4.1 to 4.3

Chapter 5 Sec: 5.1 to 5.3

Unit III: Chapter 5 Sec:5.4 to 5.6

Chapter 6 Sec:6.1 to 6.4

Unit IV: Chapter 7 Sec: 7.1 to 7.4

Unit V: Chapter 8 Sec: 8.1 to 8.4

CORE COURSE – XII

24UMA507: OPERATIONS RESEARCH

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Apply linear programming techniques, including graphical and simplex methods, to formulate and solve optimization problems in real-life situations.	K1 – K4
Unit II	CO2	Analyze and solve dual problems, transportation, assignment, and transshipment models to optimize resource allocation efficiently.	K1 – K4
Unit III	CO3	Develop and solve network optimization problems such as shortest path, minimum spanning tree, maximum flow, and project scheduling using CPM and PERT techniques.	K1 – K4
Unit IV	CO4	Evaluate and apply inventory control models, including EOQ, to minimize total inventory costs and improve decision-making.	K1 – K4
Unit V	CO5	Analyze decision-making problems under certainty, risk, and uncertainty, and apply game theory concepts to strategic decision-making scenarios.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

Unit I: Linear Programming Problem

Operations Research Models – Solving the Operations Research model – Queueing and simulation models – Linear Programming Problem (LPP) – Two variable LPP model – Graphical LPP Solution – Simplex method – Artificial Starting Solution – Special cases in the simplex Method.

Unit II: Dual Programming Problem, Transportation and Assignment Problem

Definition of the dual problem – Primal - dual relationships – Definition of the transportation model – Nontraditional transportation models – The transportation algorithm – The assignment model – The transhipment model.

Unit III: Network models

Scope and Definition of Network models – Minimal Spanning tree algorithm – Shortest route problem– Maximal flow model – Critical Path (CPM) — Program Evaluation and Review Technique (PERT).

Unit IV: Deterministic inventory models

General inventory model – Role of demand in the development of Inventory models – Static Economic – Order – Quantity (EOQ) models.

Unit V: Decision Analysis and Games

Decision making under certainity – Analytic Hirerarchy process – Decision making under risk – Decision under uncertainity – Game theory.

Textbook:

1. Hamdy A. Taha, Operations Research: An Introduction, 8th Edition (2017), Pearson Publication.

Unit I: Chapter 1 Sec: 1.1 to 1.3

Chapter 2 Sec: 2.1,2.2

Chapter 3 Sec: 3.1 to 3.5

Unit II: Chapter 4 Sec: 4.1,4.2

Chapter 5 Sec: 5.1 to 5.4

Unit III: Chapter 6 Sec: 6.1 to 6.5

Unit IV: Chapter 11 Sec:11.1 to 11.4

Unit V: Chapter 13 Sec: 13.1 to 13.4

DISCIPLINE CENTRIC ELECTIVE I

24UMA701: FUZZY MATHEMATICS

Course Outcome:

Unit	CO	Upon completion of this course the students will be able to	Cognitive Level
Unit – I	CO1	Understand the fundamental concepts of fuzzy sets, fuzzy numbers and basic operation	K1-K4
Unit – II	CO2	Explain and analyze the differences between fuzzy sets and crisp sets using Alpha-cuts and extension Principles.	K1-K4
Unit – III	CO3	Analyze fuzzy logic components such as fuzzy propositions and inference rules.	K1-K4
Unit-IV	CO4	Understand and analyze the role of fuzzy logic in databases and information retrieval systems.	K1-K4
Unit-V	CO5	Analyze fuzzy decision-making methods for individual and group based multi-criteria problems	K1-K4

K1 - Remember; K2 – Understand; K3 – Apply; K4 – Analyze

Syllabus

Unit I: From Classical (Crisp) Sets to Fuzzy Sets

Introduction – Crisp Sets: An Overview – Fuzzy Sets: Basic Types – Fuzzy Sets: Basic Concepts – Characteristics and Significance of the Paradigm Shift.

Unit II: Fuzzy Sets Versus Crisp Sets

Additional Properties of $\alpha - cut$s, Representation of fuzzy sets, Extension Principle for fuzzy sets

Unit III: Fuzzy Logic

Classical Logic: An Overview -Multivalued logics - Fuzzy Propositions – Fuzzy Quantifiers – Linguistic Hedges – Inference from conditional fuzzy proposition

Unit IV: Pattern Recognition, Fuzzy Databases and information Retrieval Systems Introduction, Fuzzy clustering, Fuzzy Pattern Recognition, Fuzzy Image Processing, General Discussion – Fuzzy Databases – Fuzzy Information Retrieval

Unit V: Fuzzy decision making:

General Discussion - Individual decision making - multi person decision making - multi criteria decision making -fuzzy ranking methods.

Textbooks:

1. George J.Klir/Bo Yuan, Fuzzy Sets and Fuzzy Logic, (2000), Prentice Hall of India.

Unit I: Chapter 1 Sec: 1.1 to 1.5

Unit II: Chapter 2 Sec: 2.1 to 2.3

Unit III: Chapter 8 Sec: 8.1 to 8.6

Unit IV: Chapter 13 Sec: 13.1 to 13.4

Chapter 14 Sec: 14.1 to 14.3

Unit V: Chapter 15 Sec: 15.1 to 15.6

CORE COURSE PRACTICAL – I

24UMA551: NUMERICAL METHODS WITH MATLAB PROGRAMMING LAB

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO 1	Apply MATLAB software to solve numerical and mathematical problems practically.	K1 – K4
CO 2	Implement algorithms for root finding, interpolation, differentiation, and integration using MATLAB.	K1 – K4
CO 3	Visualize and interpret results using 2D and 3D plots in MATLAB.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. Write a MATLAB Program to Find the Root of an Equation using the Bisection Method
2. Write a MATLAB Program to Find Roots using the Newton-Raphson Method
3. Write a MATLAB Program to Solve Nonlinear Equations using the Method of False Position (Regular Falsi)
4. Write a MATLAB Program to Perform Newton's Forward Interpolation
5. Write a MATLAB Program to Perform Newton's Backward Interpolation
6. Write a MATLAB Program for Lagrange Interpolation
7. Write a MATLAB Program to Evaluate Integrals using the Trapezoidal Rule
8. Write a MATLAB Program to Evaluate Integrals using Simpson's 1/3 Rule and 3/8 Rule
9. Write a MATLAB Program to Apply Euler-Maclaurin Formula for Numerical Integration
10. Write a MATLAB Program to Solve Linear Systems using Gauss Elimination Methods
11. Write a MATLAB Program to Solve Linear Systems using Gauss **J**acobi Methods
12. Write a MATLAB Program to Solve Linear Systems using Gauss-Seidal Methods
13. Write a MATLAB Program for Euler's Method for Solving ODE
14. Write a MATLAB Program for Runge - Kutta 4^{th} Order Method
15. Write a MATLAB Program for Adams Predictor - Corrector Method

Textbook:

1. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 4th Edition (2019), McGraw-Hill

DISCIPLINE CENTRIC ELECTIVE I

24UMA703: FOUNDATIONS OF DATA SCIENCE

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Apply data-centric programming concepts, understand computing environments, and implement best practices for handling and processing data.	K1 – K4
Unit II	CO2	Analyze and apply clustering techniques such as k-means, hierarchical, and density-based methods to identify patterns and structures in datasets.	K1 – K4
Unit III	CO3	Apply dimensionality reduction techniques, including Principal Component Analysis and other methods, to simplify high-dimensional data and enhance visualization.	K1 – K4
Unit IV	CO4	Develop and implement machine learning models using algorithms such as logistic regression, decision trees, support	K1 – K4

Syllabus

Unit I: Programming with Data

Introduction- The computing environment- Hardware- Best practices- Data-centric coding-Getting help-Conclusion.

Unit II: Clustering

Introduction- Visualization- Distances- Partitioning and the k-means algorithm- Hierarchical clustering Case study- Model-based methods- Density-based methods- Dealing with network data - Challenges.

Unit III: Dimensionality Reduction

Introduction-The geometry of data and dimension- Principal Component Analysis- Good projections - Non-integer dimensions- Dimension reduction on the Grassmannian-Dimensionality reduction in the presence of symmetry- Category theory applied to data visualization- Other methods- Interesting theorems on dimension- Conclusion.

Unit IV: Machine Learning

Introduction- Training dataset and test dataset- Machine learning workflow- Implementing the ML workflow- Gradient descent- Logistic regression- Na¨ıve Bayes classifier- Support vector machines- Decision trees-Ensemble methods.

Unit V: Deep Learning

Introduction- Multilayer perceptron - Training techniques- Convolutional neural networks-Recurrent neural network- Transformers - Deep Learning frameworks.

Textbook:

1. Nathan Carter, Data Science for Mathematicians, 1st Edition (2021), CRC Press.

Unit I: Chapter 2 Sec: 2.1 to 2.6

Unit II: Chapter 5 Sec: 5.1 to 5.11

Unit III: Chapter 7 Sec: 7.1 to 7.11

Unit IV: Chapter 8 Sec: 8.1 to 8.11

Unit V: Chapter 9 Sec: 9.1 to 9.9

DISCIPLINE CENTRIC ELECTIVE I

24UMA705: BANKING & FINANCE

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Apply fundamental concepts of portfolio mathematics, including asset prices, returns, long/short positions, and portfolio return calculations.	K1 – K4
Unit II	CO2	Analyze the Markowitz Mean-Variance optimization model, formulate the optimization problem, and derive the efficient frontier.	K1 – K4
Unit III	CO3	Evaluate properties of efficient portfolios, including mean-variance characteristics, and apply the fund separation theorem and optimization with a risk-free asset.	K1 – K4
Unit IV	CO4	Apply the Capital Asset Pricing Model (CAPM) to calculate expected returns, interpret the Security Market Line, and understand empirical tests of the model.	K1 – K4
Unit V	CO5	Develop pricing models for multi-period dynamic markets using no-arbitrage conditions, risk-neutral valuation, and the fundamental theorems of asset pricing.	K1 – K4

Syllabus

Unit-I

Portfolio selection -Introductory comments- Asset Prices and Returns- Investor's Portfolio-Long and Short Positions- Return on a Portfolio-Mathematical Notation.

Unit-II

Mean-variance Portfolio Analysis- the Markowitz Model-Basic Notions- Optimization Problem- Formulation and Discussion- Assumptions- Efficient Portfolios and Efficient frontier- Solution to the Markowitz Optimization Problem- Statement of the main result-Discussion- Proof of the main result

Unit-III

Properties of Efficient Portfolios- Mean and variance of the return on an efficient Portolio – Description of the efficient frontier- A fund separation Theorem- the Markowitz model with a risk -free asset data of the model- Portfolio Optimization with a risk-free asset Solution to the Portfolio Selection Problem

Unit-IV

Capital Asset Pricing Model (CAPM)- A general Result- An Equilibrium Approach to the CAPM-The Sharpe- Lintner Mossin Formula- Security Market line and the Pricing formula-CAPM as a Factor Model- Applying theory to practice – sharpe's and Jensen's test

Unit-V

Dynamic Securities market model-Multi Period Model of an asset market – basic securities and derivative securities – no arbitrage pricing main result hypothesis and Net present value-Risk Neutral Pricing-Risk Neutral Pricing, Measures- fundamental theorem of asset pricing-asset pricing in complete markets.

Textbook:

1. Igor V. Evstigneev, Thorsten Hens, Klaus Reiner Schenk – Hoppe, Mathematical Financial Economics, (2015), Springer.

Unit-1 Ch1 Sec1.1 to 1.4

Unit-II Ch2 Sec 2.1 to 2.4 & Ch3 sec 3.1to 3.3

Unit-III Ch4 Sec 4.1to4.3 & Ch5 Sec 5.1 to 5.3

Unit-IV Ch 7 Sec 7.1to 7.3 & Ch8 Sec 8.1 to8.3

Unit-V Ch 11 Sec11.1to 11.4 Ch12 Sec 12.1 to 12.3

DISCIPLINE CENTRIC ELECTIVE I

24UMA707: PROGRAMMING WITH C++ AND PYTHON

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Understand the fundamentals of algorithms, asymptotic notations (Big O, Omega, Theta), and analyze time and space complexity.	K1 – K4
Unit II	CO2	Implement linear data structures including arrays, linked lists, stacks, and queues using C++ and Python.	K1 – K4
Unit III	CO3	Apply searching (linear, binary) and sorting (bubble, selection, insertion, merge, quick) algorithms to solve problems.	K1 – K4
Unit IV	CO4	Analyze and implement non-linear data structures such as trees AVL), graphs (BFS, DFS), and hash tables.	K1 – K4
Unit V	CO5	Evaluate algorithmic paradigms including divide and conquer, dynamic programming, greedy methods, and backtracking for real-world optimization problems.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

Unit I: Introduction to Data Structures and Algorithms

Introduction – Structure– Foundations of Data Structures and Algorithms – Data Structures and Algorithms – Data and Logic in Problem Solving – Real World Analogies – Significance of DSA in Software Development – Role of DSA in Building Efficient Applications – Real-world Use Cases of DSA – Industry Relevance and Expectations from DSA Knowledge – Classification of Data Structures – Linear Data Structures: Arrays, Linked Lists, Stacks, and Queues – Arrays – Linked Lists – Stacks - Queues .

Unit II: Arrays and Strings

Introduction – Structure – Arrays – Need for Arrays – Key Benefits of Arrays – Contiguous Memory Storage in Arrays – Contiguous Memory Storage in Arrays – Fixed Size and Homogeneous Data Type – Characteristics of Arrays – Index-Based Access – Random Access with Constant Time Complexity – Limitations – Declaration and Initialization of Arrays – Static and Dynamic Allocation – Static Allocation – Default Values and Partial Initialization – Default Values and Partial Initialization – Default Values – Partial Initialization.

Unit III: Linked Lists

Introduction – Structure – Introduction to Linked Lists – Structure of a Node – Data Field —Pointer Field – Memory Representation of Nodes – Singly Linked Lists – Creation of Singly Linked Lists – Initialization of Head and Tail Pointers – Traversal in Singly Linked

Lists – Insertion Operations – Insertion at the Beginning – Insertion at the End – Insertion at a Specific Position – Doubly Linked Lists – Operations on Doubly Linked Lists – Forward Traversal – Backward Traversal – Insertion Operations in Doubly Linked Lists – Insertion at the Beginning – Insertion at the End.

Unit IV: Stacks, Queues and Deques

Introduction – Structure – Introduction to Linear Abstract Data Types Stack – Stack Fundamentals – Stack Operations – Array-Based Stack Implementation – Linked List-Based Stack Implementation – Applications of Stacks – Queue – Queue Fundamentals – Queue Operations – Array – Based Queue Implementation – Circular Queue Implementation – Linked List-Based Queue Implementation – Priority Queues – Types of Priority Queues – Applications of Queues.

Unit V: Hash Tables and Unordered Maps

Introduction – Structure – Introduction to Hashing – Importance of Efficient Data Retrieval – Key-Value Pair Organization – Hash Functions and Hash Tables – Hash Functions – Role of Hash Functions in Indexing – Properties of Effective Hash Functions – Structure of Hash Tables – Arrangement of Key-Value Pairs – Indexing Process in Hash Tables – Average-Case Constant-Time Performance – Collision Handling – Chaining – Working Principle – Strength and Limitations.

Textbook:

1. Divyashree Mallarapu, Sandeep Telkar R, Yasmeen Shaikh, Guruprasad Konnurmath Modern Data Structures and Algorithms Foundational Principles of Data Structures and Algorithms in C++ and Python, 1st Edition (2026), Orange Education Pvt Ltd, AVA.

Unit I: Chapter 1 Sec: 1.1 to 1.5

Unit II: Chapter 2 Sec: 2.1 to 2.4

Unit III: Chapter 3 Sec: 3.1 to 3.5

Unit IV: Chapter 4 Sec: 4.1 to 4.5

Unit V: Chapter 5 Sec: 5.1 to 5.5

DISCIPLINE CENTRIC ELECTIVE I

24UGP791: EDUCATION PSYCHOLOGY

Course Outcomes:

Unit	CO	Upon Completion of this course the students will be able to	Cognitive Level
Unit I	CO1	Understand and explain the fundamental concepts of cognitive psychology including perception, attention, learning, memory, and language processes	K1 – K4
Unit II	CO2	Apply principles and theories of perception and attention to analyze human behaviours in real-life and educational contexts	K1 – K4
Unit III	CO3	Analyze various theories of learning and their applications in behavior modification and skill acquisition	K1 – K4
Unit IV	CO4	Evaluate different models and processes of memory including Encoding , storage and retrieval in cognitive functioning	K1 – K4
Unit V	CO5	Evaluate different models and processes of memory including encoding, storage, and retrieval in cognitive functioning	K1 – K4

Syllabus

Unit I: Perception and perceptual processes

Meaning and nature of perception- approaches to visual perception- bottom-up approach-top-down approach- theories of visual perception – Gibson's theory of direct perception- the template matching theory- feature-matching theory- Gregory's theory of perception and approach & principles of perceptual organisation- perception of distance, direction, constancy& illusions

Unit II: Attention

Meaning and nature- signs and effects of attention- factor or determinants of attention-classification of attention- selective attention-meaning and nature- theories of selective attention-automatic and controlled process in attention-controlled processing in attention – executive attention- influencing sustained attention- theories of sustained attention-divided attention- the phenomenon of shifting –span of attention

Unit III: Learning Meaning Process and Theories

Meaning and definition of the term learning- the process of learning- theories of learning-Thorndike's connectionism- laws of learning- Watson and Pavlov's classical conditioning-skinner operant conditioning- Guthrie's theory of Continuous conditioning- Hull's systematic Behaviour theory- Gestalt theory of Insightful learning – Toman's sign learning

Unit IV: Memory

Meaning and nature- process of memorisation- encoding storage and retrial- thpe of memory-models of memory-Atkinson and Shiffrins model- Miller's information processing –

Dual coding model- Baddeley's model- Tulving multiple memory systems model- Parallel distribution processing models-long term memory- measurement of memory

Unit V: Language and language process

Introduction- Human Language – characteristic Features – forms of Language-origin of language- Neurological Basis of language- language structure- comprehension- thought- development of Oral vocabulary- Oral expression or speech power- reading ability- theories of language development

Textbook:

1. S.K Mangal and Shubhra Mangal, Cognitive Psychology,(2025), PHI Learning Private Limited, Delhi

Unit I - Chapter 6 (Page No. 78 - 97)

Unit II – Chapter 8 (Page No. 114 - 130)

Unit III – Chapter 9 (Page No. 137 - 167)

Unit IV – Chapter 11 (Page No. 178 - 202)

Unit V – Chapter 13 (Page No.218 – 234)

DISCIPLINE CENTRIC ELECTIVE LABORATORY I

24UMA751: MATHEMATICAL MODELLING

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO1	Apply mathematical modeling techniques to represent and analyze real-world phenomena such as population growth, epidemics, and physical processes.	K1 – K4
CO2	Use computational tools to solve optimization problems and perform Monte Carlo simulations effectively.	K1 – K4
CO3	Analyze discrete dynamical systems and optimization models to interpret long-term behavior and make data-driven decisions.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. Write a program to draw a Charts for given data using excel solver tool.
2. Write a program to draw a Modelling with proportionality: Population Growth, Radioactive decay and free-falling object using excel solver tool.
3. Write a program to fit straight lines analytically, geometric similarity and linearizable models using excel solver tool.
4. Write a program to predict discrete dynamical system concepts and examples, long term behaviour and equilibria, discrete logistic equation using excel solver tool.
5. Write a program to predict linear predator-prey model, SIR model of epidemics, and SIS model using excel solver tool.
6. Write a program to predict Monte Carlo Simulation: Flipping a coin, Area under a curve, car dealership contest and the birthday problem using excel solver tool.
7. Write a program to predict formulation of linear programming and their solutions using excel solver tool.
8. Write a program to predict transportation and their solutions using excel solver tool.
9. Write a program to predict assignment problems and their solutions using excel solver tool.
10. Write a program to predict traveling salesman problem their solutions using excel solver tool.

Textbook:

1. Albright, Brain & Fox, William P., & Horton, Mathematical Modeling with Excel,2nd Edition (2020), CRC Press.

DISCIPLINE CENTRIC ELECTIVE LABORATORY I

24UMA752: PRACTICAL DATA SCIENCE

Course Outcomes:

CO	Upon completion of this course the students will be able to	Cognitive Level
CO 1	Understand the installation and configuration of the Data Science environment including Python, Jupyter Notebook, and development tools on different operating systems.	K1-K4
CO2	Apply techniques to import, manage, clean, and preprocess datasets from mul sources using Python and R.	K1-K4
CO3	Analyze and manage Python projects using Git, GitHub, and PyCharm by performing version control operations such as commit and push.	K1-K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. Setting up Data Science Environment Installing Python on Windows
2. Installation Python on Mac
3. Setting Up Jupyter Notebooks
4. Installing Jupyter Notebooks
5. Importing CSV Files
6. Importing Excel Files
7. Importing SQL Data
8. Importing data in R
9. Data Cleaning Techniques in Python
10. Data Handling Missing Values
11. Getting Started with GitHub
12. Setting Up a Python Project with Git
13. Using PyCharm to Manage Git and GitHub
14. Committing and Pushing Changes from PyCharm

Textbook:

1.Python and R Build and Manage Streamlined Workflows with Python and R for Real-World Insights and Analysis,2026 (Edition).

DISCIPLINE CENTRIC ELECTIVE LABORATORY I

24UMA753: QUANTITATIVE APTITUDE

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO1	Apply fundamental mathematical concepts such as decimals, roots, indices, and surds to solve quantitative problems accurately.	K1 – K4
CO2	Analyze and solve real – life problem scenarios profit & loss, partnership, pipe & cisterns, boats & streams,and trains.	K1 – K4
CO3	Evaluate and Compute solutions for advanced aptitude topics including mixtures, simple & Compound interest, Calendars, clocks, permutations & combinations, and Probability.	K1 – K4

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze

Syllabus

1. Problems on Decimal Fractions
2. Problems on Square Roots and Cube Roots
3. Problems on Ages.
4. Problems on Surds and Indices
5. Problems on Profit & Loss
6. Problems on Partnership
7. Problems on Pipes & Cistern.
8. Problems on Boats and Streams.
9. Problems on Trains
10. Problems on Alligation or Mixture
11. Problems on Simple Interest-Compound Interest.
12. Problems on Calendar & Clocks
13. Problems on Permutation and Combinations
14. Problems on Probability

Textbook:

Dr. R. S. Aggarwal, Quantitative Aptitude for Competitive Examinations, Revised Edition (2017), S.Chand and company Limited

DISCIPLINE CENTRIC ELECTIVE LABORATORY I

24UMA754: C++ AND PYTHON PROGRAMMING LAB

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO1	Apply fundamental programming concepts such as classes, structures, arrays, pointers, and input/output operations to develop basic programs in C++ and Python.	K1 – K4
CO2	Analyze and implement logical solutions using control structures, loops, and functions for solving real-world computational problems.	K1 – K4
CO3	Evaluate and develop programs for practical applications such as employee data processing and algorithms like Fibonacci, prime numbers, GCD, and palindrome checking.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. Write a C++ program to display Names, Roll No.. and grade of 3 students who have appeared in the examination. Declare the class of name, roll no.. and grade. Create an array of class objects. Read and display the contents of the array.

2. Write a C++ program to declare struct. Initialize and display contents of member.

3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class members.

4. Given that EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary, and print data members.

5. Write a C++ program to read the data of N employee and compute the net salary of each employee (DA = 52% of basic and IT = 30% of gross salary).

6. Write a C++ program to illustrate the concepts of console I/O operations.

7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.

8. Print the below triangle using for loop. 5

4 4

3 3 3

2 2 2 2

1 1 1 1 1

9. Write a Program to check whether the given input is digit or lowercase character or uppercase character or a special character (use ‘ if – else – if ladder)

10. Python Program to Print the Fibonacci sequence using while loop.

11. Python Program to print all prime numbers in a given interval (use break)

12. i) Write a program to convert a list and tuple into arrays.

ii) Write a program to find common values between two arrays.

13. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.

14. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built – in function Len to check the length of a string.

E-Resources:

1. https://nptel.ac.in/
2. https://swayam.gov.in/
3. https://www.geeksforgeeks.org/

TECHNICAL SKILL

24UMA7381: INTRODUCTION TO LaTeX

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO1	Apply LaTeX techniques to create well-structured and professional documents, including reports, articles, and presentations.	K1 – K4
CO2	Use LaTeX tools to format text, insert mathematical expressions, and include symbols effectively.	K1 – K4
CO3	Analyze and create documents containing mathematical expressions and frames in different formats.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. Numbering
2. Roman Letter I, II, III, so on
3. Alphabeties a, b, c.so on
4. Upper case Alphabetics A, B, C, so on
5. Include Special Symbols @, #, $, %, &, *, () {} so on
6. Include Mathematical symbols
7. Write and Display Mathematical Equations
8. Create a table in different forms
9. Import figures and graphs into latex document
10. Draw different figures using latex commands
11. Create frames in different formats
12. Create frames containing mathematical expressions
13. Create frames containing tables and figures
14. Create Bibliography In frames

Textbook:

1. Md Aquib, Advanced LaTeX,92026), Springer

DISCIPLINE CENTRIC ELECTIVE LABORATORY I

24UMA755: TEACHING OF MATHEMATICS

Course Outcomes:

CO	Upon Completion of this course the students will be able to	Cognitive Level
CO1	Understand and explain the fundamental concepts of mathematical logic, proofs, and quantifiers.	K1 – K4
CO2	Apply appropriate proof techniques (direct, contradiction, contrapositive, induction, etc.) to solve mathematical problems.	K1 – K4
CO3	Construct clear, logical, and rigorous mathematical arguments using proper definitions and terminology.	K1 – K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze

Syllabus

1. What is a proof?
2. The forward and backward process.
3. Reading proofs.
4. On definitions and mathematical terminology.
5. Quantifiers I: The Construction method.
6. Quantifiers II: The Choose Method
7. Quantifiers III: Specialization
8. Quantifiers IV: Nested Quantifiers
9. Nots of Nots, Lead to knots
10. The Contradiction method
11. The Contrapositive method
12. The Uniqueness Methods
13. Induction
14. The Either / Or Methods

Textbook:

1. Daniel Solow, How to Read and Do Proofs, 6th Edition (2014), John Wiley & Sons.