Tantia University
SRI GANGANAGAR (RAJASTHAN)
(Established by State Govt. Act 32 of 2013 & U/S 2 (f) of UGC Act. 1956)

DEPARTMENT OF MATHEMATICS

FACULTY OF ARTS CRAFT & SOCIAL SCIENCES

Learning Outcome-based Curriculum Frame Work(LOCF)

Choice Based Credit System (CBCS)

SYLLABUS

M. A. Mathematics

From Academic Session 2023-24

TANTIA UNIVERSITY
SRI GANGANAGAR

M. A. Mathematics

SEMESTER I			
S. No.	**Paper Code**	**Paper Name**	**Credits**
1	MMA101	Advanced Abstract Algebra	**4**
2	MMA102	Advanced Complex Analysis	**4**
3	MMA103	Tensor Analysis	**4**
4	MMA104	Calculus of Variation and Special Functions-I	**4**
5	MMA105	Numerical Methods –I	**4**
Total Credits			**20**
SEMESTER II			
S. No.	**Paper Code**	**Paper Name**	**Credits**
1	MMA 201	Advanced Linear Algebra	**4**
2	MMA 202	Measure Theory and Integration	**4**
3	MMA 203	Integral Transforms	**4**
4	MMA 204	Special Functions-II	**4**
5	MMA 205	Numerical Methods-II	**4**
Total Credits			**20**

SEMESTER III			
S. No.	**Paper Code**	**Paper Name**	**Credits**
Core Compulsory Paper			
1	MMA 301	Differential Equations	**4**
2	MMA 302	Discrete Mathematics	**4**
3	MMA 303	Operation Research	**4**
Elective Optional Paper (Candidate is required to select any one group of the following)			
4	MMA 304 A	Mathematical Statistics I	**4**
5	MMA 305 A	Mathematical Statistics II	**4**
6	MMA 304 B	Continuum Mechanics I	**4**
7	MMA 305 B	Continuum Mechanics II	**4**
SEMESTER IV			
S. No.	**Paper Code**	**Paper Name**	**Credits**
1	MMA 401	Integral Equations	**4**
2	MMA 402	Graph Theory	**4**
3	MMA 403	Programming in C++	**4**
4	MMA 404	Research Methodology and Statistical Analysis	**4**
5	MMA 405	Dissertation Submission and Viva -Voce	**4**

NOTE: The question paper shall be divided into 3 sections:

Section A (9 marks) shall comprise of 9 compulsory questions of 1 marks each and 3 questions from each Unit (Answer is not more than 50 words).

Section B (20 marks) shall comprise of 2 questions from each Unit and candidate has to attempt 5 questions (atleast one question from each Unit), 4 marks for each question (Answer in not more than 200 words) and

Section C (21 marks) shall comprise of 2 questions from each Unit and candidate has to attempt 3 questions (one question from each Unit), 7 marks for each question (Answer in not more than 500 words).

DETAILED SYLLABUS

MMA -101 ADVANCED ABSTRACT ALGEBRA

Unit I

Homomorphism theorems on groups, conjugate elements. Classes and class equation of a finite group, Sylow Theorem, p - Sylow subgroup, structure theorem for finite abelian groups. Normal and subnormal series, Composition series, Jordan-Holder Theorem, Solvable group, Nilpotent groups.

Unit II

Euclidean and polynomial rings, Polynomials over rational fields. The Eisenstein criterion, Polynomial rings over commutative ring, unique factorization domain, Chain condition and rings.

Unit III

Modules, generators and relations, structure theorem for modules of Euclidean domains/PIDs.

Books Recommended for Reference :

1. Maclane and Birkoff : Algebra, Macmillan & Co.
2. I.N. Herstein : Topics in Algebra, Wiley Eastern India Ltd.
3. I.S. Luthar and B.S. Passi : Algebra Vol-I Groups, Vol-II Rings, Narosa Publishing House.
4. Gokhroo et.al. : Advanced Abstract Algebra, Navkar Prakashan, Ajmer
5. Bhattacharya, P.B. etc. : Basic Abstract Algebra (II ed.) Camb. Univ. Press India, 1997
6. P.M. Cohn : Algebra vol I,II & III, John Wiley & Sons, 1982-89, 91
7. Vivek Sahai & Vikas Bist : Algebra, Narosa Publishing, 1999
8. Gopal Krishanan, N.S. :University Algebra, New Age International Publication,
9. B.S. Vatssa : Modern Algebra, 1999 New Age International Publication.

MMA - 102 ADVANCED COMPLEX ANALYSIS

Unit I

Analytic functions, Cauchy-Reimann equations and it's properties. Complex line and contour integrals, Cauchy Theorem for an analytic function, Cauchy's integral formula and it's properties, Morera's Theorem ,Taylor's and Laurent's series, Lioville's Theorem, Maximum modulus principle , SchwarzLemma**.**

Unit II

Zeros and Singularities, Branch points, Reimann Theorem on removable Singularity, open mappingTheorem, Casoratti-Weirstrass Theorem, Residue at a pole, Residue at infinity, Cauchy's Residues theorem, Evaluation of Integrals**.**

Unit III

Meromorphic functions, Argument principle, Rouche's Theorem, Analytic continuation, Complete analytic function, Uniqueness of analytic continuation, Analytic continuation by means of power series, Singularities of a power series on its circle ofconvergence, Schwarz's reflection principle.

Books recommended for Reference:

1. S. Ponnusamy : Foundation of Complex Analysis, Narosa Publishing House, New Delhi
2. Shanti Narain : Complex Analysis, S.Chand & Co., New Delhi
3. R.V. Churchil & J.W. Brown : Complex Variables and Applications, McGraw-Hill.
4. L.V. Ahlfords : Complex Analysis, McGraw Hill Co., 1979
5. Gokhroo et.al : Complex Analysis, Navkar Prakashan, Ajmer
6. K.P. Gupta: Complex Analysis, Krishana Prakashan Mandir, Meerut.
7. B. Choudhary : Complex Analysis, Wiley Eastern Ltd. New Delhi.
8. Purohit and Goel : Complex Analysis, Jaipur Publishing House, Jaipur.
9. S.K. Sharma etc. : Complex Analytic Functions Theory and Applications, New Age International

MMA - 103 TENSOR ANALYSIS

Unit I

Transformation of Coordinates, Covarient, Contravarient and mixed tensor, Invariants, Addition, subtraction and multiplication of tensors. Contractions of tensors, Quotient Law of tensors. Fundamental Tensors, Length of Curve, Associated tensors.

Unit II

Christoffel symbols, Covariant Differentiation of tensors, Laws of covariant differentiation, Geodesics, Null Geodesics, Geodesics Co-ordinates Parallelism, Covarient derivatives.

Unit III

Tensor: Reimann-christroffel tensor, curvature tensor, Bianchi Reimann curvature, Flat Space, Ricci space of constant curvature. Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

Books Recommended for Reference:

1. Berry Spain : Tensor Calculus
2. Bansal J.L.: Tensor Calculus, Jaipur Publishing House, Jaipur.
3. Raj Bali : Tensor Calculus, Navkar Prakashan, Ajmer
4. Goodbody, A M :Cartesian Tensor

MMA - 104

CALCULUS OF VARIATION AND SPECIAL FUNCTIONS-I

Unit I

Functionals, Variation of a functional and its properties, Variational problems with fixed boundaries, Euler's equation, Extremals, Functional dependent on several unknown functions and their first order derivatives.Functionals dependent on higher order derivatives,

Unit II

Functionals dependent on the fuction of more than one independent variable. Variatonal problems in parametric form. Applications of Calculus of variations

Unit III

Series solution of Gauss hypergeometric equation, Gauss hypergeometric function and its properties, integral representation, contiguous function relations, Kummer's Confluent Hypergeometric Functions.

Legendre's polynomial, generating function, recurrence relations, orthogonal properties, Beltrami's result, Legendre function of first and second kind, Associated Legendre's functions.

Books Recommended for Reference:

1. Rainville E.D. : Special Functions chapter : 1, 6, 8, 11 & 12
2. Slater L.J. : Confluent Hypergeometric Functions, Cambridge University Press. 1966
3. L.J. Slater : Generalized Hypergeometric Functions, Cambridge University Press, 1966
4. Gokhroo et.al : Special Functions, Navkar Prakashan, Ajmer
5. Saran et al; : Speical Functions, Pragati Prakashan, Meerut
6. Gokhroo et.al : Calculus of Variations, Navkar Prakashan, Ajmer

MMA - 105 NUMERICAL METHODS – I

Unit I

Iterative methods : Simple iteration, theory of iteration, acceleration of conversion, methods for multiple and complex roots, Newton Raphson method for simultaneous equations, convergence of iteration process in the case of several unknowns.

Unit II

Solution of polynomial equations, polynomial evaluation, real and complex roots, synthetic division, the Birge-Vieta, Baristow and Graffe's root squaring methods, system of simultaneous equation (Linear) –direct methods –Methods of determination

Unit III

Gauss elimination, Gauss Jordan, Cholesky, Partition methods of successive, approximate – conjugate Gracient, Gauss and Jacobi iteration, Gauss Seidal iteration & Relaxation methods. Eigen value problem, basic properties of eigen values and eigen vectors, power methods for finding all eigen pairs of a matrix, complex eigen values.

Books Recommended for Reference:

1. Jain, Iyengar & Jain:Numerical Analysis
2. Jain M.K. :Numerical Solution of differential equations
3. Gokhroo et. al. :Advanced Numerical Methods, Navkar Prakashan, AJMER

MMA -201 ADVANCED LINEAR ALGEBRA

Unit I

Vector space of a linear transformation, Matrix representation of a linear transformation, Change of Basis, Similarity, Eigen value and eigenvectors for a linear operator, Cayley-Hamilton theorem,

Unit II

Diagonalization, Minimal Polynomial and equation. Linear functionals, Dual and bidual of a vector space and their properties, Annhilators, Invariance, projections and its properties, Adjoints of a linear transformation and its properties, Bilinear quadratic and hermitian forms, Inner product spaces, Cauchy- Schwarz inequality.

Unit III

Orthogonal vectors, orthogonal complements, ortho-normal sets and bases, Bessel's inequality for finite dimensional spaces, Gram-Schmidt orthogonalization process.

Books Recommended for Reference :

1. Hofman and Kunz. : Linear Algebra, Prentice Hall of India.
2. K.B. Datta : Matrix and Linear Algebra,
3. Prentice Hall of India Pvt. Ltd., New Delhi.
4. Gokhroo et.al : Advanced Linear Algebra, Navkar Prakashan, Ajmer
5. Purohit, Pareek, Sharma, : Linear Algebra, Jaipur Publishing House
6. P.M. Cohn : Algebra vol I,II & III, John Wiley & Sons, 1982-89, 91
7. Gopal Krishanan, N.S. (II ed.): University Algebra New Age International Publication
8. Gopal Krishanan,N.S:University Algebra through 600 problems New Age International Publicaton
9. B.S. Vatssa : Modern Algebra, 1999 New Age International Publication, (1999)

MMA - 202 MEASURE THEORY AND INTEGRATION

Unit I

Countable sets. Outer measure of a set and its properties. Measurable sets. Lebesgue measure, a non-measurable set. Measurable functions and their properties.

Unit II

Convergence of sequence of measurable functions. Concept of almost everywhere. Littlewood's three principles. Lebesgue integral of measurable functions, Lebesgue theorem on the passage to the limit under the integral sign.

Unit III

Summable functions, the space of square summable functions, function of finite variation, stieltjesintegral, the indefinite lebesgue integral.

Books Recommended for Reference :

1. T.M. Apostal : Mathematical Analysis, Narosa Publishing House, New Delhi (1985)
2. P.K. Jain and V.P. Gupta: Lebesgue Measure and Integration, New Age International Pub. Ltd., New Delhi (Reprint 2000)
3. G.N. Purohit : Lebesgue Measure and Integration, Jaipur Publishing House, Jaipur
4. T.S. Nahar : Measure Theory, Navkar Publications, Ajmer.
5. Indra Kumar Rana : An Introduction to Measure and Integration,Narosa Publishing House, New Delhi (1997)
6. G-de Barra, Gupta : Measure Theory and Integration, Wiley Eastern Ltd. 1981

MMA - 203 INTEGRAL TRANSFORMS

Unit I

Laplace Transforms : Definition and properties, Rules of manipulation: Laplace Transform of derivatives. Inverse Laplace Transform, Convolution theorem , Complex inversion formula. Application of Laplace Transform for the solution of ordinary differential equations with constant coefficients and with variable coefficient, Simultaneous ordinary differential equations. Partial differential equations, Integral and difference equations,

Unit II

Fourier Transform : Fourier Sine and Cosine transform, Inverse Fourier Transform convolution Theorem. Fourier transform of derivatives. Application of Fourier Transform in the solution of boundary value problems. Application to the solution of partial differential equations,

Unit III

Hankel Transform : Definition and Elementary properties: Inverse theorem Hankel Transform of derivatives. Parsesals Theorem. Mellin Transform :Properties and integrals. Application of Hankel Transform in the solution of boundary value problems.

Books Recommended for Reference :

1. Sneddon.I.N : The use of integral Transforms, Mcgraw Hill Co., 1966
2. Spegal M.R : Theory and problems of Laplace transform, Schaum Series,TMH
3. Gokhroo et. al. : Integral Transform, Navkar Prakashan, Ajmer.
4. Vasishtha et. al. : Integral Transforms, Krishna Prakashan Mandir, Meerut
5. M.D. Raisingania: Integral Transforms, Kedar Nath Ram Nath, Meerut.

MMA - 204 SPECIAL FUNCTIONS-II

Unit I

Bessel's differential equation and its solution, Bessel's functions. Recurrence relations. Orthogonaproperties. Rodrigue's formula, modified Bessel function. Integral representation of Bessel's function.

Unit II

Hermite Polynomial, their generating function and general integral properties, recurrence formulae, Rodrigue's formula, orthogonality. Lagurre polynomials and functions, their generating function and general integral properties. Rodrigue's formula, orthogonal expansion of polynomials.

Unit III

Jacobi Polynomial, Generating Function, Rodrigues formula, orthogonality of Jacobi Polynomial, Chebyshev Polynomial, Generating Function of Chebysheve Polynomial, Orthogonal Properties of Chebyshev Polynomial.

Books Recommended for Reference :

1. Rainville E.D : Special Functions chapter : 1, 6, 8, 11 & 12
2. Gokhroo et.al : Special Functions, Navkar Prakashan, Ajmer
3. Saran et al :Speical Functions, Pragati Prakashan, Meerut

MMA - 205 Numerical Methods II

Unit I

Curve fitting and function approximation, least square error criterion, linear regression, polynomial fitting and other curve fitting, approximation of functions by Taylor series andChebyshev polynomials.

Unit II

Numerical solution of ordinary differential equations, Taylor series methods, Euler's and modified Euler's method, Runge-Kutta method upto fourth order, multi step method (Predictor-Corrector Strategies).

Unit III

Stability analysis -single and multi step methods, Difference methods for Boundary value problems, ordinary differential equations, boundary value problems, shooting methods. Finite difference methods, difference scheme for non linear boundary value problems of the certain type with the given initial conditions..

Books Recommended for Reference :

1. Jain, Iyengar & Jain: Numerical Analysis
2. Jain M.K. : Numerical Solution of differential equations
3. Gokhroo et. al.: Advanced Numerical Methods, Navkar Prakashan, AJMER

SEMESTER – III

(Core Compulsory Paper)

MMA 301: DIFFERENTIAL EQUATIONS

3 Hrs 50 Marks

Unit -I

Numerical Solutions of ordinary differential Equations, Euler's method, Picard's Method of Successive approximation, Picard's method for simultaneous equation, Taylor's series method, Runge Kutta Method, Two point Boundary value Problems, Pertubations Method.

Unit II

Existence and uniqueness of solution of $dy/dx = f(x,y)$, Classification of second order PDE, Separation of variable for heat Equation, Wave equations and Laplace Equation, Linear homogeneous BVP, Eigen values and eigen functions, Sturm-Liouville BVP.

Unit III

Orthogonality of eigen functions, Lagrange's identity, properties of Eigen functions, important theorems of sturm Liouville system, Periodic functions. Green's functions : Non-homegeneous Sturm-Liouville BVP (method of Green's function), Procedure of contructing the Green's function and solution of BVP, properties of Green's function, Inhomogeneous boundary conditions, Dirac delta function, Bilinear formula for Green's function, Modified Green's function.

MMA 302: DIFFERENTIAL EQUATIONS

3 Hrs 50 Marks

Unit -I

Lattices: Lattices as partially ordered sets, their properties, duality, Lattices as algebraic systems, Sub lattices, Direct products, Bounded Lattices, Complete Lattices, Complemented Lattices and Distributive lattices.

Unit II

Boolean Algebras: Boolean Algebras as lattices, Various Boolean Identities, The Switching Algebra examples. Sub algebras, Direct products and Homeomorphisms,

Boolean forms and their Equivalence, Min-term Boolean forms, Sum of product Canonical forms, Minimization of Boolean functions.

Unit III

Formal Logic: Statements, Symbolic Representation of statements, Truth tables, Logical equivalence, Algebra of propositions, Conditional proposition, Converse, Contrapositive and Inverse, Bi-conditional Proposition, Negation of compound statement, Tautologies and contradictions, Normal forms , Predicates and Validity of arguments, Quantifiers.

Languages, Automata, Grammars:

Alphabet, Words, Free Semigroup, Languages, Regular Expressions, Regular Languages, Finite State Automata, Grammars.

MMA 302: OPERATION RESEARCH

3 Hrs 50 Marks

Unit -I

The theory of simplex method, Simplex algorithm, Duality, Degeneracy, Variation of the simplex method Dual Simplex method, Revised simplex method, Sensitivity analysis (Post optimal solution)

Unit -II

Integer programming, Bounded variable problem, Convex function, Saddle point.

Conditions for non-linear programming problem, Kuhn Tucker conditions for optimization for non- linear programming problem.

Convex programming with separable convex objectives.

Unit -III

Quadratic programming method for quadratic programmes due to Wolfe and Frank, Duality theorem for quadratic programming,

Dynamic programming its notion and formulation.

Elective Optional Paper
(Candidate is required to select any one group of the following)

Group A

MMA 304 A: MATHEMATICAL STATISTICS I

3 Hrs 50 Marks

Unit -I

Sample spaces, Combination of events, Statistical independence, Conditional probability-Bays theorem Repeated trials, Random Variable, Distribution function, Probability function, Density function.

Unit II

Mathematical expectation, Generating function (mfg and pgf) continuous probability distribution characteristic function, Fourier's Inversion, Chebyshev and Kolmogorov inequality. Weak and Strong laws of large numbers, Normal, Hyper-geometric, Rectangular, Negative Binominal, Beta, Gamma and Cauchy's distribution.

Unit III

Methods of least square and curve fitting, correlation and regression coefficient. Index numbers, Introduction, Price-relatives, Quantity relatives, Value relatives. Link and Chain relatives, Aggregate methods, Fisher's Ideal Index, Change of the base period of the index numbers.

MMA 305 A: MATHEMATICAL STATISTICS II

3 Hrs 50 Marks

Unit -I

Elementary sampling theory, Distribution of means of samples from Binomial, Cauchy, Rectangular, and normal distributions. Distribution of second order moments in samples from normal population, Exact distributions of $\chi 2$, t, z and F.

Unit –II

Statistics in samples from a normal population, their simple properties and applications. Test of significance of difference between two means and two standard deviations for large samples with modification for small samples and taken from normal population

Unit –III

Association of attributes, Analysis of variance, simple cases (one criteria and two criteria of classification), Elementary statistical Theory of Estimation. Fisher's criteria for the best estimator, Consistent, Efficient and sufficient estimator, Method of Maximum Likelihood estimators and other methods of estimation, Method of least squares.

Group B

MMA 304 B: CONTINUUM MECHANICS -I

3 Hrs 50 Marks

Unit -I

Cartesian Tensors, Index notations and transformation, Laws of Cartesian tensors, Addition, Subtraction and multiplication of Cartesian tensor, Gradient of a scalar function, Divergence of a vector function and curl of a vector function using the Index notation, the identity stokes, Gauss and Green's theorems.

Unit -II

The continuum approach classification of continuous media, Body forces and surface forces, Components of stress tensor, Force and moment equation of equilibrium.

Unit –III

The stress quardric, Principle stresses and Principle axes, Stress invariants and the stress deviator tensor, Maximum shearing stress, Lagrangian and Eulerian description of deformation of flow, the comoving derivative, Velocity and acceleration, The continuity equation. Strain tensors, the linear rotation tensor and rotation vector, Analysis of rotation displacement.

MMA 305 B: CONTINUUM MECHANICS -II

3 Hrs 50 Marks

Unit -I

Geometrical meaning of the components of the linear strain tensor, Principle axis theory for the linear strain tensor, properties of Linear strain tensors, The linear cubical dilatation, Compatibility equations for the linear strain components.
The rate of strain tensors and the vorticity tensor, The rate of rotation vector and the vorticity, Properties of the rate of strain tensor, Rate of cubical dilatation.

Unit -II

Law of conservation of mass and Eulerain Continuity equation, The momentum integral theorem and the equation of motion, Kinetic equation of state, The first and the second law of thermodynamics and the dissipation function.
Application: (Linear elasticity): Assumption and basic equations, Generalized Hooke's Law for an isotropic Homogeneous solid, Compatibility equations, Classification of types of problems in linear elasticity, The Principle of superposition.

Unit –III

The strain energy function, The uniqueness theorem P.I. Relationship and the work kinetic energy equation, Irrotational flow and the velocity potential, Kinetic equation of state and the First Law of Thermodynamics. The equation of continuity, the equations of motion, Vorticity-Strema Surface for inviscid flow, Bernoulli's equations, Irrotational flow and the velocity potential, Similarity parameters and fluid flow.

SEMESTER – IV

MMA 401: INTEGRAL EQUATION

3 Hrs 50 Marks

Unit -I

Linear integral equations: Definition and classification. Conversion of initial and boundary value problems to an integral equation. Eigen values and Eigen functions. Solution of homogeneous and general fredholm integral equations of second kind with separable kernels.

Unit –II

Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations. Resolvent kernel and its re- sults. Conditions of uniform convergence and uniqueness of series solution. Integral equations with symmetric kernels: Orthogonal system of functions. Fundamental properties of eigen values and eigen functions for symmetric kernels. Expansion in eigen functions and bilinear form

Unit –III

Hilbert-Schmidt theorem. Solution of Fredholm integral equations of second kind by using Hilbert- Schemidt theorem. Solution of Volterra integral equations of second kind with convolution type kernels by Laplace transform. Solution of singular integral equations by Fourier transform. Classical Fredholm theory: Fredholm theorems. Solution of Fredholm integral equation of second kind by using Fredholm first theorem.

MMA 402: GRAPH THEORY

3 Hrs 50 Marks

Unit -I

Graph and related terminology.
Complete graph, Weighted graph, Planar and non-planar graph, Regular graph, Graph isomorphism and homeomorphism, Euler's formula, Statement and applications of Kuratowski's theorem

Unit -II

Representing graphs in computer system, Coloring of graph. Graph connectivity, Konigsberg bridge problem, Euleria path and Elerian circuit, Hamiltonian path and Hamiltonian circuit. Study of Shortest path and shortest distance, Dijkstra's algorithm.

Unit –III

Paths between the vertices, Path matrix, Warshall's algorithm, cut point, bridge, cut sets and connectivity, Menger's theorem.
Tree and related terminology, spanning tree, Finding minimum spanning tree by Kruskal's algorithm and Prim's algorithm, inorder, preorder, and postorder tree traversals, Binary tree, Expression trees and reverse polish notation (RPN)

MMA 403: PROGRAMMING IN C++

3 Hrs 60Marks

Unit -I

Introduction to C++, Character set, Constant, Variables and Data Types, Operator, precedence associativity and priority of operations.

Unit –II

Arithmetic Expression, Operator Precedence and Associatively, Input, conditional Statements, Conditional Operator, Scope of Variables, Type Conversion. Decision making statement, Looping and branching, while statement, do statement , for statement, go to statement.

Unit –III

Standard and User-Defined Function, Recursive function, Passing By Value And Reference, Pointers and Functions, Reference and Functions. Array: One Two And Multidimensional, Passing Array to a Function.

PRACTICAL **20 Marks**

Simple C++ Programming of problems of numerical analysis, solution of quadratic equations, mean and standard deviation, fitting of curves, correlation coefficient, applications into matrices, sorting of numerical character string data etc.

Distribution of Marks:

Two Practical's (5 Marks each)	= 10 Marks
Practical Record	= 5 Marks
Viva-Voce	= 5 Marks
Total	= 20 Marks

MMA 404: RESEARCH METHODOLOGY AND STATISTICIAL ANALYSIS

3 Hrs 50 Marks

Unit -I Foundations of Research Methodology

Introduction to Research

Types of research (qualitative, quantitative, mixed methods), Research ethics and integrity, Literature review techniques, Formulating research questions and hypotheses, Sampling methods and techniques, Experimental vs. observational designs ,Surveys and questionnaires ,Interviews and focus groups, Observational methods ,Thematic analysis ,Grounded theory ,Case study methodologies

Unit 2: Statistical Analysis Techniques

Introduction to Statistics

Descriptive statistics (mean, median, mode, standard deviation), Probability concepts and distributions, inferential statistics basics. Hypothesis Testing, Null and alternative hypotheses Type I and Type II errors p-values and confidence intervals

Advanced Statistical Techniques Regression analysis (linear and logistic) ANOVA and MANOVA Non-parametric tests (Chi-square, Mann-Whitney)

Statistical Software Applications Introduction to R, SPSS, or Python for statistical analysis Data visualization techniques Hands-on analysis using real datasets

Unit 3: Application and Interpretation of Research Findings

Writing Research Proposals

Structure of a research proposal, Literature review synthesis, Budgeting and timeline considerations Data Interpretation and Reporting, Interpreting statistical results

Communicating findings to different audiences, Preparing tables, graphs, and charts

Advanced Topics in Research Systematic reviews and meta-analysis Longitudinal vs. cross-sectional studies Addressing biases and limitations in research Capstone Project

Designing and conducting an independent research project Applying methodology and statistical techniques learned Presenting findings to peers and faculty

MMA 405: DISSERTATION SUBMISSION AND VIVA-VOCE

50 Marks

Dissertation Submission	50
Viva- voce	10