Course Structure and Code of UG (BE, B. Ph., B. Arch., Bio. Tech.)

1. **MA 1201** **Engineering Mathematics**
2. **MA 1103** **Remedial Mathematics (B Ph)**
3. **MA 1105** **Mathematics for Architect (B. Arch.)**

4. **MA 2201** **Advanced Engineering Mathematics**
5. **MA 2103** **Mathematics-I (B Ph)**

6. **MA 3103** **Mathematics-II(B Ph)**

7. **CS 4103** **Scientific Computing**
8. **CS 4104** **Scientific Computing Lab**
9. **CS 4101** **Discrete Mathematical Structures**
10. **IT 4101** **Discrete Mathematics & Graph Theory**
11. **MA 4109** **Probability, Statistics And Numerical Techniques**
12. **MA4110** **Probability, Statistics And Numerical Techniques Lab**

MA 1201 Engineering Mathematics (3-1-0-4)

Module I

Sequences, bounded sequences, upper and lower bounds, monotonic sequences, limits of a sequence, convergence of sequence, Cauchy's general principle of convergence, Cauchy's theorems on limits (No proof). [3L]

Module II

Convergence of series of real numbers of positive terms. P series test, comparison tests, Cauchy's root test, D' Alembert's ratio test, Raabe's test. Gauss's Ratio Test, Logarithmic and Higher logarithmic Ratio Test, Absolute and conditional convergence, Leibnitz's Rule for Alternating series Test. [6L]

Module III

Generalized Mean Value Theorem, Maclaurin's series, Taylor's series of functions.
Functions of several variables, level cures, limits, countinuity. Partial Derivatives. Euler's theorem on Homogeneous functions, chain Rule, transformation of independent variables, Total differential. Jacobians Taylor's series in two or more variables. Maximum, minimum and saddle points of functions of two variables. Several independent variables Lagrange's method of Undetermined Multipliers. [8L]

Module IV

Beta and Gamma functions, Double integrals, area, change of order of integration, Evaluation of integrals by transforming into polar co-ordinates. Evaluation of Triple integrals. Volume and surface area by double and Triple integration by transforming in to cylindrical and spherical polar co-ordinates. [5L]

Module V

Sketching polar equations of conic section, equation of tangent and normal line to a conic section equation of tangent and normal line to a conic section including chord of contact, director circle and asymptote. [4L]

Model VI

First order differential equations linear and Bernoulli's equation, Reduction of order curvature, normal vector, torsion and TNB frame, tangential and normal components of velocity and acceleration, radical and transverse acceleration. Motion in polar. And cylindrical coordinates. Directional derivatives, Gradient, Divergence and curl. Expansions, identities. Tangent plane and normal lines Gradient, divergence and curl in curvilinear co-ordinates. [5L]

Module VII

Line integrals, Work, Circulation, Flux, Paths independence, Potential function, Conservative field, Green's theorem in plane, surface and volume integrals Gauss's Divergence theorem, Stoke's theorem. Applications. [4L]

Text Books:

1: M.D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th editionh, Pearson Educations, 2008.
2: Dennis G. Zill, Warren S. Wright: Advanced Engineering Mathematics, 4th edition. Jones Nad Bartlertt Publishers, 2010
3: E. Kreyszig: Advanced Engineering Mathematics, 8th Edition John Wiley and sons 1999.
4: T.M. Apostol: Calculus Vols 1 and 11.2nd Edition. John Wiley and sons, 1967 and 1969,

MA 1103 Remedial Mathematics(B.Ph.)

Algebra:

Module I

Complex number; Definition, Fundamental operations with complex numbers, modulus. Amplitude, conjugate of a complex number, Graphical representation of complex numbers. Demoivre's theorem, Roots of complex numbers. [5L]

Module II

Arithmetic, Geometric and Harmonic progressions, Binomial theorem, Exponential and logarithmic series. [4L]

Co-ordinate Geometry (Two dimensional):

Module III

Cartesian & Polar Co-ordinates, Distance between two points, Area of a triangle, Equation of a straight line, Angle between two lines, Distance of a point from a straight line,Equations of circle, parabola, ellipse, and Hyperbola. [6L]

Determinants and Matrices:

Module IV

Determinants and their properties. Cramer's rule,
Types of matrices. Addition, Multiplication, Transpose, Adjoint and Inverse of a matrix,
Solution of linear system of equations by matrix inversion method. [5L]

Trigonometry:

Module V

Circular Functions, trigonometric functions and equations,
Sides of a trangle and T-ratios, Inverse trigonometric functions, multiple and submultiple angles. [6L]

Differential Calculus:

Module VI

Function, Limit and Continuity, Differential coefficients, Differentiation of Algebraic Inverse and Transcendental functions, Differentiation by substitution, Differentiation of Implicit functions. Logarithmic differentiation, Differentiation of parametric function. [6L]

Module VII

Geometrical meaning of the derivative Equation of tangent and normal lines to a curve. Rate measure and approximations. [3L]

Books Suggested:

1. Agarwal: "Senior Secondary School Mathematics," Bharti Bhawan Publications
2. Sharma: "Mathematics," Dhanpat Rai Publication
3. Sinha: "A Text Book of Algebra and Coordinate Geometry," Students Friends Publications.
4. Das Mukherjee: "Differential Calculus, " U.N. Dhar Publications.

MA 1105 Mathematics for Architect (B. Arch.)

Module I

Matrix: Adjoin, Transpose and Inverse of Matrices, Orthogonal matrix, Rank of Matrix, Consistency and Inconsistency of a linear Equation. Eigen Value and Eigen Vector. [6L]

Module II

Statistics & Probability: Measure of Central Tendency and Measure of Dispersion. Kurtosis, Curve fitting, Method of least Squares (Straight Line and Parabola), Correlation and Regression. [5L]

Module III

Differential Calculus: Successive differentiation, Leibnitz's Theorem, Tangent and Normal, Curvature (Cartesian and parametric forms only), Indeterminate forms [4L]

Module IV

Taylor's and Maclaurin's expansion, Maxima, Minima for a function of one variable, Point of Inflexion , Concavity and Convexity. [5L]

Module V

Partial differentiation, Euler's Theorem, Total Differential Coefficient, Change of variables, Telor's and Maclaurin's expansion for two variable, Maxima, Minima for a function of two variable. [5L]

Module VI

Integral Calculus: Reduction Formula. [4L]

Module VII

Introduction to Double and Triple integrals. Calculation of areas in simple cases without the use of multiple integrals. [6L]

Books Recommended

1. Differential Calculus. Das and Mukherjee (U.N. Dhur & Co.)
2. Integral Calculus. Das and Mukherjee (U.N. Dhur & Co.)
3. Engineering Mathematics. H.K. Dass
4. Higher Engineering Mathematics B.S. Grewal (Khanna Publishers)
5. Probability and statistics-Gupta and kapur

MA 2201 ADVANCED ENGINEERING MATHEMATICS

Module I

Linear Differential Equations of Higher Order with constant coefficients Differential Equations with Variable Coefficients: Reducible to Equations with Variable Coefficients:- Cauchy – Euler Differential Equation. Legendre Linear Differential Equation. Solution of Differential Equation by transformation (or, change) of Independent Variable. [5L]

Module II

Reduction of Differential Equation to Normal Form (by reducing the order of the Differential Equation). Solution by the method of Variation of Parameters. Series Solution of differential Equations. [5L]

Module III

Bessel's differential Equation and its General solution**.** Bessel's Functions and its properties. Legendre's Differential Equation and Legendre Polynomials. Properties of Legendre Polynomials. Introduction to Hypergeometric Equation. Introduction to Hermite Differential Equations. Introduction to Chebyshev Polynomials. [5L]

Module IV

Eigen Values and Eigen Functions. Sturm – Liouville Problems.

Periodic Functions. Dirichlet's Conditions on Fourier Series. Euler's Formulae for Fourier Coefficients. Half – range Series. Fourier Series of Functions with Arbitrary period. [5L]

Module V

Function of Complex Variables. Limit, Continuity, Differentiability of a Complex Variable. Cauchy – Riemann Differential Equations in Cartesian and Polar Forms. Analytic Function. Cauchy's Integral Theorem. Cauchy's Integral Formula. [5L]

Module VI

Taylor Series, Laurent Series. Residues, Poles, Residue Theorem. Residue at Poles. Contour Integrals of Trigonometric $(0 \text{ to } 2\pi)$ and Algebraic Equations $(-\infty \text{ to } \infty)$. Conformal Mapping and Bilinear Transformation. [5L]

Module VII

Partial Differential Equation, Lagrange's Method, Homogeneous and Non-homogeneous Higher Order Equations(with Constant Coefficients). One dimensional Heat Equation. One dimensional Wave Equation [5L]

Text Books:

1. Simmons G. F., Differential Equations with Applications and Historical Notes. TMH, 2nd ed., 2003.
2. R. V. Churchill and J. W. Brown, Complex Variables and Applications, 8th ed., 2009, McGraw – Hill.
3. Dennis G. Zill, Warren S. Wright, Advanced Engineering Mathematics,4th ed.2011
4. E. Kreyszig, Advanced Engineering Mathematics, Jhon Wiley and Sons, 8th ed., 1999

Reference Books:

1. Edwards and Penney, Differential Equations and Boundary Value Problems, Pearson Education, 3rd ed.
2. Shepley L. Ross, Differential Equations Wiley India Pvt. Ltd., 3rd ed.
3. Birkhoff and Rota, Ordinary Differential Equations, Wiley India Pvt. Ltd., 4th ed.
4. Zill, Differential Equations, Thomson Learning, 5th ed., 2004
5. A.D. Wunsch, Complex Variables with Applications, Pearson Education Inc., 3rd ed.
6. M.J. Ablowitz and A.S.Fokas, Complex Variables Introduction and Applications, Cambridge Texts, 2nd ed.
7. Murray R Spiegel, Theory and Problems of Vector Analysis and an Introduction to Tensor Analysis, McGraw-Hill, Schaum's Outline Series.

MA 2103 Mathematics I (B.PH.)

Integral Calculus:

Module I

Integration as the inverse process of differentiation. Integration by the methods of substitution. By parts and by partial fractions. [5L]

Module II

The definite integrals and their simple applications to area. Length of curves. Volume and surface of revolution. [5L]

Differential Equations:

Module III

First order Orinary Differential Equations: Equations of first order and first degree. Equations with separable variables. Homogeneous. Linear and exact equations. [5L]

Module IV

Second order linear equations with constant coefficients. Simple applications in growth and Decay problems etc. [5L]

Laplace transfoms:

Module V

Definition. Transfrorms of elementary functions. Properties of linearity and shifting [5L]

Module VI

Inverse Laplace transforms, transforms of derivatives. [5L]

Module VII

Solution of ordinary and simultancous differential equations. [5L]

Suggested Books:

1. Integral calculus by Das and Mukherjee (U.N. Dhar Publications)
2. Differential equations By Schaum. McGraw Hill
3. The use of Integral transforms, By I.N. Sueddon. Tata McGraw Hill
4. Higher Engineering Mathematics. By B.S. Grewal. Khanna Publishers.

MA 3103 Mathematics II (B.Ph.)

Biometrics:

Module I

Definition of data. Data organization, diagrammatic representation of data, bar. Pie. 2-D and 3-D diagrams. Measures of central tendency measures of dispersion standard deviation. Coefficient of variation, kurtosis skewness. [5L]

Module II

Correlation and regression analysis, method of least squares, statistical inference. [5L]

Module III

Probability and events, Baye's Therem, probability Theorems, probability distributions. [4L]

Module IV

Elementary ideas of binomial, Poisson and normal distribution.
Student's and paired t-test, elements of ANOVA.
Applications to pharmaceutical sciences. [6L]

Numerical Analysis:

Module IV

Numerical solutions of simple algebraic and transcendental equations by graphical and Newton-Raphson methods, Solution of system of simultaneous linear equations by Gauss-Seidal Method [7L]

Module IV

Interpolation, Newton's forward and backward interpolation formula. [3L]

Module IV

Numerical differentiation, Integration by Trapezoidal and Simpson's $1/3^{rd}$ rule. [5L]

Suggested Books

1. Pharmaceutical statistics – Practical and climical applications. 3^{rd} Editions By Marcel and Dekker, Stanford Bolton
2. Biostatistics – A foundation for analysis in Health sciences, By Daniel. John Willey
3. Mathematical statisties by Gupta and Kapoor
4. Numerical methods for Engineering problems By Raju and Muthu. Macmillan India Ltd.

CS 4103 Scientific Computing

A– Numerical Computing

Module – I

High Speed Computation: Introduction, Computer Arithmetic, Errors, Machine Computation.

Transcendental and Polynomial Equations: Introduction, Bisection Method, Iterative Methods, Rate of Convergence, Methods for Complex Roots, Polynomial Equations. [4L]

Module –II

System of Linear Algebraic Equations and Eigenvalue Problems: Introduction, Direct Methods, Error analysis,j Iteration Methods, Eigenvalues and Eigen Vectors. Interpolation and Approximation: Introduction to Lagrange and Newton Interpolations, Finite difference operators, Interpolating polynomial using finite differences, Hermit interpolations, Piecewise and spine interpolation. [6L]

Module – III

Differentiation and Integration: Introduction, Numerical differentiation, Numerical integration, Methods based on interpolation. Ordinary Differential Equatjions: Introduction, Euler methods, Single and Multistep methods, Predictor-corrector methods. [5L]

B-Statistical Computing

Module– IV

Empirical andf kProbability Distributions: Basic Concepts, The Mean variance, and Standard Deviation, Continuous – Type Data, Exploratory Data Analysis, Graphical Comparisons of Data Sets, Probability Density and Mass Functions.

Probability: Properties of Probability, Methods of Enumeriation, Conditional Probability, Independent Events, Bayes Theorem. [5L]

Module – V & VI

Discrete, Continues & Multivariable Distributions: Random Variables of the Discrete Type, Mathematical Expectation, Bernoulli Trials and the Binomial Distribution, The Moment – Generating Function, The Poisson Distribution, Random Variables of the Continuous Type, The Uniform and Exponential Distributions, The Gamma and Chi-Square Distributions, The Normal Distribution, Distributions of Functions of a Random Variable, Distributions of Two Random Variables.

Sampling Distribution Theory: Independent Random Variables, Distributions of Sums of Independent Random Variables, Random Functions Associated with Normal Distributions, The Central Limit Theorem, Approximations for Discrete Distributions, The t and F Distribution. [10L]

Module – VII

Estimation & Tests of Statistical Hypotheses: Point Estimajtion, Confidence Intervals for Means, Confidence Intervals for Difference of Two Means, Sample Size, Tests about Proportions, Tests of the Equality of Two Normal Distributions, Chi-Square Goodness of Fit Tests, Contingency Tables, Tests of the Equality of Several Means. [5L]

Text Books:

1. Jain, M.K., etal: Numerical Methods for Scientific and Engineering Computation, 3rd Edn. New Age Publication, New Delhi , 1999
2. Hogg, R.V. & Ranis E. A. : Probability and Statistical Inference, 6th Edn., Pearson Education, New Delhi.

Reference Books:-

1. Sastrty, S.S. – Introductory Methods of Numerical Analysis, 4th Edn., PHI, New Delhi, 2005
2. Hines, W.W. et al – Probability and Statististics in Engineering, 4th edn., John Witey, Singapore (Indian Reprint), 2003.
3. Veerarajan, T. – Probability, Statististics and Random Processes, 2nd Edn., TMH, New Delhi, 2003.

CS 4104 Scientific Computing Lab

CS 4101 Discrete Mathematical Structures

Module – I & II

Logic and Mathematical Reasoning: Logic, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Recursive Definition and Algorithms, Program Correctness. [8L]

Module – III & IV

Functions and Relations: Functions, Sequences and Summations, The Growth Functions, Relations and Their Properties, Non – array Relations & Their Applications, Representing Relations, Closures of Relations, Equivalence Reloads, Partial Orderings. [8L]

Module – V

Graphs: Introduction to Graphs, Graph Terminology and Representation, Connectivity, Euler and Hamiltonian Paths, Shortest Path Programs,. [6L]

Module – VI

Trees: Introduction and applications of trees, Tree Traversal, Spanning Trees, Minimum Spanning trees. [5L]

Module – VII

Subgroups, Groups and Coding: Binary Operations, Semi groups, Products and Quotients of Semi groups, Groups, Product and Quotients of Groups, Coding of Binary Information and Error Correction, Decoding and Error Correction. [8]

Text Books:

1. B.Kolman et.al – Discrete mathematical Structures, 5th Ed^{n}, Pearson Education, New Delhi – 2004
2. K.H. Rosen – Discrete Mathematics and Its Applications – 4th Ed^{n}, Tata McGraw Hill, New Delhi – 2001.

Reference Books:

J.P. Tremblay et.al – Discrete Mathematical Structures with Applications to Computer Science, TMH, New Delhi – 2004.

IT 4101 Discrete Mathematics & Graph Theory

Module – I

Introduction to Logic: Compound Statements, Proofs in Mathematics, Truth Tables, The Algebra of Propositions, Logical Arguments. [5L]

Module – II

Induction and Recursion: Mathematical Induction, Recursively Defined Sequences, Solving Recurrence Relations; The Characteristic Polynomial, Solving Recurrence Relations; Generating Functions. [5L]

Module – III

Principles of Counting and Algorithms: The Principle of Inclusion – Exclusion, The Addition and Multiplication Rules, The Pigeon-Hole Principle, What is an Algorithm?, Complexity, Searching and Sorting, Enumeration of Permutations and Combinations [5L]

Module – IV & V

Graphs, Paths and Circuits and Applications: A Gentle Introduction, Definitions and Basic Properties, Isomorphism, Euler Ian Circuits, Hamiltonian Cycles, The Adjacency Matrix, Shortest Path Algorithms, The Chinese Postman Problem, Digraphs, Tournaments, Scheduling Problems. [8L]

Module – VI

Trees and Searching: What is a Tree?, Properties of Trees, Spanning Trees, Minimum Spanning Tree Algorithms, Acyclic Digraphs and Bellman's Algorithm, Depth – First Search. [6L]

Module – VII

Planar Graphs, Colorings and Maximal Flows: Planar Graphs, Coloring Graphs, Flows and Cuts, Constructing Maximal Flows, Applications. [6L]

Text Books:

E.G. Goodaire & M.M. Parmenter –Discrete Mahmatics with Graph Theory, 2nd Edn Pearson Education, New Delhi – 2002.

Reference Books:

1. B. Kolman et.al-Discrete mathematical Structures, 5th Edn, Pearson Education, New Delhi – 2004
2. K.H. Rosen – Discrete Mathematics and Its Applications – 4th Edn, Tata Mc Graw Hill, New Delhi – 2001
3. D.B. West – Introduction to Graph Theory, 2nd Edn, Pearson Education, New Delhi 2002
4. N. Deo – Graph Theory with Application to Engineering and Computer Science, PHI, New Delhi – 2004.

MA 4109 Probability, Statistics and Numerical Techniques

Module – I

High Speed Computation: Introduction, Computer Arithmetic, Errors, Machine Computation.
Transcendental and Polynomial Equations: Introduction, Bisection Method, Iterative Methods, Rate of Convergence, Methods for Complex Roots, Polynomial Equations. [5L]

Module –II

System of Linear Algebraic Equations and Eigen value Problems: Introduction, Direct Methods, Error analysis, Iteration Methods, Eigen values and Eigen Vectors. Interpolation and Approximation: Introduction to Lagrange and Newton Interpolations, Finite difference operators, Interpolating polynomial using finite differences, Hermit interpolations, Piecewise and spine interpolation. [5L]

Module – III

Differentiation and Integration: Introduction, Numerical differentiation, Numerical integration, Methods based on interpolation. Ordinary Differential Equations: Introduction, Euler methods, Single and Multistep methods, Predictor-corrector methods. [5L]

Module– IV

Graphical Statistics-histogram, scatter plot, ogive, bar diagrams (including multiple and percentage), average, dispersion, skewness and kurtosis and their statistical measures, Exploratory Data Analysis, Empirical and classical definitions of Probability, Addition theorem, Conditional Probability, multiplication theorem, Independent Events, Bayes Theorem. [5L]

Module – V

Random variables and Probability distributions, Discrete, Continues & Multivariable Distributions: Mathematical Expectation, Bernoulli Trials and the Binomial Distribution, The Moment – Generating Function, The Poisson Distribution, The Uniform and Exponential Distributions, The Normal Distribution, Distributions of Functions of a Random Variable, Distributions of Two Random Variables. [5L]

Module VI

Sampling Distribution Theory: Independent Random Variables, Distributions of Sums of Independent Random Variables, Random Functions Associated with Normal Distributions, The Central Limit Theorem, Approximations for Discrete Distributions, The t and F Distribution. The Gamma and Chi-Square Distributions. [5L]

Module – VII

Estimation & Tests of Statistical Hypotheses: Point Estimation, test of significance and Confidence Intervals for Means, Confidence Intervals for Difference of Two Means, Sample Size, Tests about Proportions, Tests of the Equality of Two Normal Distributions, Chi-Square Goodness of Fit Tests, Contingency Tables, Tests of the Equality of Several Means, F test for equality of two population variances [5L]

Text Books:

3. Jain, M.K., et. al: Numerical Methods for Scientific and Engineering Computation, 3rd Edn. New Age Publication, New Delhi , 1999
4. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Reference Books:-

4. Sastrty, S.S. – Introductory Methods of Numerical Analysis, 4th Edn., PHI, New Delhi, 2005
5. Hines, W.W. et al – Probability and Statististics in Engineering, 4th edn., John Witey, Singapore (Indian Reprint), 2003.
6. Veerarajan, T. – Probability, Statististics and Random Processes, 2nd Edn., TMH, New Delhi, 2003

MA 4110 Probability, Statistics and Numerical Techniques Lab