

FIRST YEAR - B.Sc., Mathematics:

THEORY OF EQUATIONS AND TRIGONOMETRY

UNIT I

Relations between the roots and coefficients of a general polynomial equation in one variable – Transformation of equations.

UNIT II

Solutions of cubic equations – Cardan's Trigonometrical method only Biquadratic equations.

UNIT III

Direct and Inverse circular and Hyperbolic functions.

UNIT IV

Logarithm of a complex quantity – Expansion of trigonometrical functions.

UNIT V

Gregory's series – Summation of Series.

TEXT BOOKS

1 T. K. Manicavachagom Pillay, T. Natarajan and K. S. Ganapathy, Algebra Vol-1, S. Viswanathan (Printers and Publishers)Pvt. Ltd, (1999)

2 S. Narayanan and T. K. Manicavachagom Pillay, Trigonometry, S. Viswanathan (Printers and Publishers)Pvt. Ltd, (1997)

REFERENCE BOOK

P. R. Vittal and Malini, Algebra and Trigonometry, Margam Publications(2008).

DIFFERENTIAL CALULUS

UNIT I

Differentiation and Elementary Functions:

The Slope of a curve – the derivative – Limits – Powers, Sums, Products and Quotients – Chain Rule – Higher Derivatives – Implicit Differentiation.

Sine and Cosines:

The derivatives, Two Basic Limits.

UNIT II

The Mean Value Theorem:

The Maximum and Minimum Theorem – Increasing and Decreasing Functions – Mean Value Theorem.

UNIT III

Inverse Functions:

Definition of Inverse Functions – Derivatives of Inverse Functions – Arcsine – Arctangent

Polar Co-Ordinates:

Angle between radius vector and Tangent – Angle of Intersection of two curves – Pedal Equation of a curve.

UNIT IV

Successive Differentiation – Leibnitz Theorem – Partial Differentiation – Euler's Theorem – Taylor's Series – Maclaurin Series Expansion.

UNIT V

Asymptotes – Radius of Curvature – Test for Concavity and Convexity – Points of Inflexion – Multiple Points.

TEXT books

1 A course in Calculus by Serge Lang, Springer (Fifth Edition – First Indian Reprint (2004))

2 Calculus Vol-I, T. K. Manicavachagom Pillai, Printers and Publishers (1992)

Analytical Geometry

Unit– I: Polar equation of a conic – Equation of a conic and problems. Tangent, normal and related problems.

Unit – II: Plane – Plane, general equations, angle between two planes, length of perpendicular from a given point to a plane- Problems. equations of the plane bisecting the angle between two planes Problems.

Unit – III: Straight Lines – Symmetrical form, line thro two points, reduction of unsymmetrical forms to symmetrical forms conditions for a line to lie on a plane - Problems

Plane thro a line condition for the two lines to be coplanar (Cartesian form), equation of a plane containing two lines - Problems. To find the shortest distance between two skew lines, equation of a shortest distance in Cartesian form- Problems

Unit – IV: Sphere – Equation of a sphere with center and radius - Problems. General equation of a sphere, diameter form, circular section- Problems

Unit – V: Cone – Equation of a cone with its vertex at the origin, equation of a quadratic cone with given vertex and given guiding curve, necessary conditions for general equation of 2nd degree to represent a cone Problems : Circular cone, equation of circular cone with given vertex, axis and semi vertical angles.- Problems

Text and Reference Book .

1. A text book of Analytical Geometry (Part I – Two Dimensions), T.K Manickavachagom Pillai and T.Natarajan. S.Viswanathan Printers and publishers, 2003.
2. A text book of Analytical Geometry (Part II – Three Dimensions), T.K Manickavachagom Pillai and T.Natarajan. S.Viswanathan Printers and publishers, 2008.
3. Text book of Analytical Geometry 2D, P.Durai Pandian, Emerald Publishers 1968.

DISCRETE MATHEMATICS

UNIT I

Connectives – Well Formed Formulas – Tautology – Equivalence of Formulas – Duality Law – Tautological Implications – Normal Forms.

UNIT II

Sets – Relations – Partial Ordering – Posets and their Representation – Well Ordered Sets – Algebraic Systems – Semigroups and Monoids.

UNIT III

Definition of Graphs – Application of Graphs – Finite and Infinite Graphs – Incidence and Degree – Isolated Vertex – Pendant Vertex and Null Graph – Isomorphism – Subgraphs.

UNIT IV

Walks - Paths and Circuits – Connected Graphs – Disconnected Graphs and Components – Euler Graphs – Operations on Graphs – More on Euler Graphs – Hamiltonian Paths and Circuits.

UNIT V

Trees – Some Properties of Trees – Pendant Vertices in a tree – Distance and Centres in a Tree – Rooted and Binary Trees – Counting Trees – Spanning Trees.

TEXT BOOKS

- 1 J.P. Trembly and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Company (1997)
- 2 Narasingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India Pvt Ltd. New Delhi(2005)

INTEGRAL CALCULUS

UNIT I

Integrals – Properties of Definite Integrals – Integration by parts – Bernoulli's Formula – Integration as Limit of an infinite sum, Reduction formula for n th power of $\sin x$, $\cos x$, $\tan x$.

UNIT II

Multiple Integrals: Definition of Double Integral – Evaluation of Double Integral – Double Integral in polar Coordinates – Triple Integrals.

UNIT III

Change of Variable: Jacobian – Change of Variable in the case of two variables and three variables – Transformation from Cartesian to Polar Coordinates – Transformation from Cartesian to Spherical Polar coordinates.

UNIT IV

Improper Integrals – Beta and Gamma functions – Vector Differentiation – Gradient – Divergence – Curl.

UNIT V

Basics in Vector functions – Line Integrals – Independence of Integration – Conservative field and Scalar Potential – Line Integral of Conservative Vector – Surface Integrals – Volume Integrals.

TEXT BOOKS

- 1 Calculus Vol-2, S. Narayanan and T. K. Manickavasagam Pillai, S. Viswanathan(Printers and Publishers) Pvt. Ltd.(2004)
- 2 Vector Analysis, P. Duraipandian, Emerald Publishers Pvt. Ltd(1990)
- 3 Integral Calculus, N. P. Bali, Laxmi Publications, Delhi(1991)
- 4 Calculus, George B. Thomas, Jr. And Ross L. Finney, 9th Edition, Pearson Education(2006).

ORDINARY DIFFERENTIAL EQUATION AND LAPLACE TRANSFORM

UNIT I

Ordinary Differential Equations – Linear Equations and Equations reducible to the Linear form – Exact Differential Equations – First order higher degree equations solvable for x, y, p – Clairaut form and Singular solutions – Geometrical meaning of a Differential Equations – Orthogonal trajectories.

UNIT II

Linear Differential Equations with constant Coefficients – Homogeneous linear Ordinary Differential Equations – Linear Differential Equation of Second order.

UNIT III

Transformation of the equation by changing the dependent variable/ the independent variable – Method of Variation of Parameters – Ordinary Simultaneous Differential Equations.

UNIT IV

Laplace Transforms

Definitions: Transform of 1 – Transform of the function $\exp(-at)$, $\cos at$, $\sin at$ and t^n , where n is a positive integer, $\sinh t$, $\cosh at$ Shifting Property – Second Shifting Theorem – Inverse Transforms relating to the above standard forms.

UNIT V

Application to Solution of Ordinary Differential Equations with Constant coefficients – Involving the above transforms.

TEXT BOOK

1. T. K. Manickavachagam Pillai, Calculus, Vol-1, S. Viswanathan (Printers and Publishers) Pvt. Ltd.(2004) (Relevant Portions)
2. D. A. Murray, Introductory Course in Differential Equations, Orient Longman(India), (1967).

SECOND YEAR - B.Sc MATHEMATICS

FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

UNIT I

Dirichlet's condition General Fourier Series Odd and Even Functions Half Range Sine Series Half range Cosine Series.

UNIT II

Complex form of Fourier Series Parseval's Identity Harmonic Analysis.

UNIT III

Formation of Partial Differential Equations by elimination of Constants and Arbitrary Functions Definitions of General, Particular and Complete Solutions. Singular Integral. Lagrange's Method of Solving the Linear Equation $Pp + Qq = R$.

UNIT IV

Charpit's method, Linear partial differential equation of second and higher order with constant coefficients.

UNIT V

Boundary Value Problems method of separation of variable transverse vibrations of string. The One-dimensional Heat Equations Two dimensional Heat flow Equations (Cartesian form)

Text book

Dr.M.B.K Moorthy & K.Senthilvadivu, Transforms and Partial Differential Equations, VRB Publishers, 2009.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India Edition 2010
2. Engineering Mathematics, M.K.Venkataraman, National Publications, Chennai 2009

REAL ANALYSIS – I

UNIT I

Sets and Functions:

Sets and elements – Operations on sets – Functions – Real Valued functions – Equivalence – Countability – Real numbers – Least upper bound – Greatest Lower bound.

UNIT II

Sequence of Real Numbers:

Definition of Sequence and subsequence – Limit of a sequence – Convergent sequence – Bounded sequence – Monotone sequence – Operation on convergent sequence – Limit superior and Limit inferior – Cauchy sequence.

UNIT III

Series of Real Numbers:

Convergence and Divergence – Series with non-negative terms – Alternating Series – Conditional Convergence and Absolute Convergence – Rearrangement of Series (Statements only) – Tests for absolute Convergence (Statements only) – Series whose terms form a non-increasing sequence – Summation by parts.

UNIT IV

Limits and Metric Spaces:

Limit of a function on the Real Line – Metric Spaces (Examples 4 and 5 under 4.2 c to be omitted) – Limits in Metric Spaces.

UNIT V

Continuous Functions on Metric Spaces:

Functions continuous at a point on the Real line – Reformulation – Functions continuous on a Metric Space – Open sets and Closed sets – More about Open sets – Connected sets.

TEXT BOOK

Methods of Real Analysis, Treatment as in Richard R. Goldberg, Indian Edition(1970).

STATISTICS - I

UNIT I

Probability of an event – Probability space – Total Probability – Conditional Probability – Bayes Theorem.

UNIT II

Random variables – Discrete and Continuous – Distribution function – Expected value and Moments – Moment Generating Functions and Characteristic Functions – Tchebechev's inequality.

UNIT III

Binomial, Poisson, Normal and Uniform distribution – Concept of Bivariate distribution- Marginal and Conditional Distributions.

UNIT IV

Construction of univariate and bivariate frequency distributions – Diagrammatic and graphical representation of data and frequency distributions – only bar and Pie diagrams and line diagrams – Frequency polygon – Frequency curve and Histogram – Cumulative frequency distributions – Ogives and Lorenze curves.

UNIT V

Measures of central tendency – Dispersion – Skewness and Kurtosis for Numerical data.

TEXT BOOK

Fundamentals of Mathematical Statistics, A Modern Approach, S. C. Gupta and V. K. Kapoor, SultanChand(2000).

THEORY OF NUMBERS AND FOURIER TRANSFORM

UNIT I

Primes and composite numbers – Resolving a composite number into prime factors – Divisors of a given number N – Euler's functions Φ of N , Value of Φ of N – Integral part of a Real number – Product of r consecutive integers.

UNIT II

Congruences – Criteria of divisibility of a number by 3, 9, 11 – Numbers in arithmetical progression – Fermat's theorem – Generalisation of Fermat's theorem – Wilson's theorem- Lagranges's theorem.

UNIT III

Convergent – Infinite continued fraction and simple continued fraction – Partial quotients and complete quotients – Expression of a positive rational number as a simple continued fraction- Recurring continued fraction- Properties of convergents – Sequences formed by the even convergents and the odd convergents – Approximation by the convergents – Limits to the error in taking any convergent for the continued fraction.

UNIT IV

Definition, Properties of Fourier Transforms, Linear Property, Shifting Property, Change of Scale Property, Modulation theorem, Fourier Transforms of Integrals.

UNIT V

Relation between Fourier and Laplace Transforms, Convolution Theorem for a Fourier Transform, Parseval's identity, Fourier Sine Transform and Fourier Cosine Transform.

TEXT BOOKS

1 Algebra vol. II by T. K. Manicavachagom Pillay, T. Natarajan and K. S. ganapathy, Revised and Enlarged Edition, S. viswanathan(Printers and Publishers) Pvt. Ltd, Chennai (2008).

UNIT I – CHAPTER 5 SEC 1 TO 11

UNIT II – CHAPTER 5 SEC 12 TO 18

UNIT III – CHAPTER 3 SEC 1 TO 6

2 Engineering Mathematics by M. K. Venkataraman, National Publications, Chennai(2009)

UNITS IV AND V (RELEVANT PORTIONS)

REFERENCE BOOK

Elementary Number Theory by D. M. Burton, Sixth Edition, Tata McGraw Hill Education Private Limited, New Delhi(2007)

REAL ANALYSIS – II

UNIT I

Bounded sets and totally bounded sets-Complete metric spaces-Compact metric spaces.

UNIT II

Continuous functions on Compact metric spaces-Continuity of the inverse function-Uniform Continuity.

UNIT III

Sets of measure zero-Definition of the Riemann integral-Existence of the Riemann integral-Properties of the Riemann integral-Improper integrals.

UNIT IV

Derivatives-Roll's theorem- The law of the Mean-Fundamental theorem of calculus.

UNIT V

Hyperbolic function- The exponential function-The logarithmic function – Definition of x power a – The trigonometric function – Taylor function – The Binomial theorem – L'Hopital's rule.

TEXT BOOK

Treatment as in Richard R. Goldberg, Methods of Real Analysis, Indian Edition(1970)

STATISTICS II

UNIT I

Correlation and Regression Analysis.(Sec 10.1 to 10.7 of Reference book no. 1)

UNIT II

Theory of Attributes. .(Sec 11.1 to 11.8.2 of Reference book no. 1)

UNIT III

Tests of Significance – Standard error – Large Sample tests – Exact test based on t, chi-square and F-distributions with regard to mean, variance and correlation coefficient.

UNIT IV

Test of independence in congruency tables – tests of goodness of fit – Test of hypothesis – Neymann Pearson theory – Concepts of most powerful test.

UNIT V

One way classification – Two way classification. (Sections A-5.4 to A-5.7 of Reference book no 2)

REFERENCE BOOKS

- 1 Fundamental of Mathematical Statistics, A Modern Approach, S. C. Gupta and V. K. Kapoor, Sultanchand(2000)
- 2 Fundamental of Statistics, S. C. Gupta, Himalaya(2008), Students Edition.
- 3 Statistics, R. S. N. Pillai and V. Bagavathi, Sultanchand(2008).

THIRD YEAR - B.Sc MATHEMATICS

ABSTRACT ALGEBRA

Unit I

Mapping, Equivalence relation, Congruence Modulo n , Definition of a group- Some examples of a Groups- Some Preliminary Lemmas- Subgroups.

Unit II

A counting principal – Normal Subgroups and Quotient groups – Homomorphisms.

Unit III

Automorphism – Cayley's Theorem - Permutation Groups.

Unit IV

Definition and Examples of a Rings – Some special classes of Rings – Homomorphisms- Ideals and Quotients Rings - More ideals and Quotient Rings.

Unit V

The Field of Quotients of an Integral Domain – Euclidean Rings – A Particular Euclidean Rings.

Text Book

Topics in Algebra (Second Edition) By I.N Herstein, John Wiley & Sons (2003).

Complex Analysis - I

Unit – I: Complex numbers - Definition – Algebraic properties Cartesian co-ordinates – Triangular inequality- Polar co-ordinates. Powers and roots. Region in the complex plane- The point at infinity.

Unit – II: Analytic functions – Functions of a complex variables – Mappings – Limits. Theorems on Limits – Continuity – Derivatives – Differentiation formula. Cauchy-Riemann Equations – Sufficient Conditions.

Unit – III: Cauchy-Riemann equations in Polar forms. Analytic functions and Harmonic functions .

Unit – IV: Elementary functions – Exponential functions – Trigonometric functions and their properties. Hyperbolic functions, Logarithmic functions, branches of $\log z$. Further properties of Logarithms. Complex exponent, inverse trigonometric functions.

Unit – V: Mapping by elementary functions – Linear function $1/z$, Linear fractional transformation. The function $z^{1/2}$, $\exp z$, $\sin z$, $\cos z$. Successive transformations $W = z+1/z$.

TEXT BOOK

1. Complex variable and applications, James Ward Brown and Ruel V.Churchill, Mcgraw Hill, International edition 2009.

MECHANICS – I: STATICS

Unit I : Forces

Definition of a force - Types of forces: gravity, tension, resistance, friction – Magnitude and direction of the resultant of forces on a particle - Equilibrium of a particle.

Unit II : Equilibrium of a Particle:

Equilibrium of a particle acted on by three forces - The triangle of forces - Necessary and Sufficient conditions for the equilibrium of a particle under three forces - Lami's theorem – Necessary and sufficient condition for the equilibrium of a particle under a system of forces – Equilibrium of a particle on a rough inclined plane.

Unit III : Forces on a Rigid Body:

Equivalent systems of forces - Resultant of parallel forces – Couples – Resultant of several coplanar forces – Moment of the resultant force – Varignon's theorem – Couples in a plane or in parallel planes - Resultant of a couple and force.

Unit IV

Three coplanar forces on a rigid body – Equation of the line of action of the resultant – Equilibrium of the rigid body under three coplanar forces.

Unit V: Hanging Strings :

Equilibrium of a uniform homogeneous string – Sag – Suspension bridge.

Text Book

Mechanics, P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, S.Chand and Company Ltd., New Delhi (1997).

OPERATIONS RESEARCH – I

Unit I

Linear programming problem - Graphical method – Simplex method.

Unit II

Transportation Problem

Unit III

Assignment Problem – Travelling salesman problem.

Unit IV

Replacement problem – Replacement of items that deteriorate with time – Replacement of items that fail completely.

Unit V

Network analysis – Basic concepts – Construction of network diagram – CPM – PERT.

Text Book

Operations Research, Kanti Swarup, P.K.Gupta and Man Mohan, S.Chand Publishers 1991.

LINEAR ALGEBRA

Unit I

Elementary Basic Concepts, Linear Independence – Bases.

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Unit II

Dual Spaces, Inner product spaces.

Unit III

Elementary Matrix operations and Elementary Matrices – The rank of a Matrix and Matrix inverses – Systems of Linear Equations - Theory and Computation.

Unit IV

Determinants of Order 2 Determinants of Order n- Properties of Determinants - Important facts about Determinants.

Unit V

Eigen values and Eigen vectors - Diagonalizability.

Text Book

1. Topics in Algebra, I.N . Herstein, John Wiley & Sons (2003).
2. Linear Algebra, Stephen, Friedber Vz., Prentice – Hall of India (2007).

Complex Analysis - II

Unit – I: Definite integrals, Contours , Line integrals, Examples, The Cauchy's Goursat's theorem , A preliminary lemma. Proof of Cauchy's Goursat's theorem, Simply and multiply connected domains, indefinite integrals.

Unit – II: Cauchy's integral formula, Derivative of an analytic function. : Morera's theorem, Maximum moduli of functions. : The fundamental theorem of algebra.

Unit – III: Convergence of sequence and series. Taylor's series, Observations and examples. Laurent's series, Further properties of series.

Unit – IV: Singularities - Definitions and examples. Residues - The residue theorem - The principal part of a function Poles. Quotient of analytic function.

Unit – V: Contour integration: Type I – Problems.

Contour integration: Type II Problems. Contour integration: Type III. Problems.

TEXT BOOK

1. Complex variables and Applications, James Ward Brown and V. Churchill, McGraw-Hill International Edition

MECHANICS –II: DYNAMICS

Unit I: Kinematics

Velocity – Relative velocity – Acceleration – Angular Velocity – Relative angular velocity – Rectilinear motion – Work, Power and energy.

Unit II: Central Orbit

Central forces and central orbit - Equations of a central orbit – Law of force and speed for a given orbit – Determination of the orbit when the law of force is given – Kepler's laws of planetary motion.

Unit III: Motion of a projectile under Gravity

Motion of a projectile – Nature of trajectory – Results pertaining to the motion of a projectile – Maximum horizontal range – Trajectories with a given speed of projection and a given horizontal range – Speed of a projectile – Range of an inclined plane – Maximum range on the inclined plane – Envelope of the trajectories.

Unit IV: Simple Harmonic Motion and Moment of Inertia.

Definition of simple harmonic motion – Composition of two simple harmonic motions of the same period, Moment of Inertia – Theorems of moment of Inertia – Theorem of Perpendicular axes – Theorem of parallel axes.

Unit V: Two Dimensional Motion of a Rigid Body

Two dimensional motion of a rigid body – Motion of a rigid body rotating about a fixed axis – Compound pendulum – Reaction of the axis on a rigid body revolving about a fixed axis – Equations of motion for a two dimensional motion – Motion of a uniform disk rolling down an inclined plane.

Text book

Mechanics, P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, S.Chand and Company Ltd., New Delhi (1997).

OPERATIONS RESEARCH – II

Unit I : Sequencing Problem

Problems with n jobs thro 2 machines – Problems with n jobs thro 3 machines – Problems with n jobs thro m machines.

Unit II: Dynamic Programming

Recursive approach – Computational procedure – Tabular method – Solution of LPP by dynamic programming.

Unit III: Inventory Control

Deterministic models:

- (i) Uniform rate of demand, infinite rate of production, no shortages
- (ii) Uniform rate of demand, finite rate of replenishment, no shortages
- (iii) Uniform rate of demand, instantaneous production, with shortages
- (iv) Uniform rate of demand, instantaneous production, with shortages and fixed time.

Unit IV : Games and Strategies

Competitive games – Two person zero sum games – Maximin – Minimax principle – Saddle point – Solution using the principle of dominance –Graphical problems.

Unit V: Simulation Technique

Introduction – Even type simulation – Generation of random phenomena – Monte Carlo technique – Simulation technique applied to inventory problems.

Text Book

Operations Research, Kanti Swarup, P.K.Gupta and Man Mohan, S.Chand Publishers 1991

NUMERICAL ANALYSIS USING C

Unit I

Numerical solution of algebraic and transcendental equations – Bolzano's bisection method – Successive approximation method – Regula falsi method – Newton Raphson method – Numerical solution of simultaneous linear algebraic equations – Gauss elimination method – Gauss Jordan elimination method – Gauss seidel iteration method.

Unit II

Finite difference operator – Solution of first and second order linear difference equations with constant coefficients – Non-homogeneous linear difference equation with constant coefficients.

Unit III

Interpolation – Newton Gregory forward and backward interpolation _Newtons divided difference formula – Lagrange's interpolation formula for uneven intervals – Gauss interpolation formula – Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's 1/3rd rule.

Unit IV

Numerical solution of ordinary differential equation of first and second order – Simultaneous equations – Taylor series method – Picard's method.

Unit V

Euler's methods – Improved Euler's method – Modified Euler's method – Runge Kutta method of second and fourth order – Milne's predictor corrector method.

Text book

Numerical methods in Science and Engineering, M.K.Venkataraman, National Publishing co, Chennai 2001.