Programme Outcomes for B. Sc. Mathematics

It is expected that each mathematics graduate will be able to,

1. Reason mathematically;
2. Develop abstract mathematical thinking;
3. Solve complex problems using mathematics;
4. Communicate mathematical ideas;
5. Evaluate mathematical work;
6. Demonstrate mathematical knowledge commensurate with national norms;
7. To get wide range of mathematical skills to crack various competitive examinations.

Course Outcomes for B. Sc. Mathematics

Paper – I (MT 101) : Differential and Integral Calculus

On successful completion of the course students should able to,

Understand the idea of derivative,its geometrical and physical interpretations;

1. Find the higher order derivatives;
2. Use derivatives to explore the behavior of a given function;
3. Understand the tangents and normals to the curves and angle between curves;
4. Explain the notion of limit and continuity as related to functions;
5. Use L'Hospitals rule to evaluate limits;
6. Understand the Mean Value Theorems;
7. Expand the functions using Taylors and Maclaurins Theorems;
8. Beta, Gamma Function.
9. Double Integral.

Paper – II (MT 102) : Differential Calculus and Trigonometry

On successful completion of the course students should be able to,

Understand the idea of derivative, its geometrical and physical interpretations;

1. Limit and Continuity.
2. Partial Differential Equation.
3. Chain rule.
4. Homogeneous Function.
5. Mean Value Theorem.
6. De Moiver's Theorem.
7. Series.

Paper – III (MT 103): OrdinaryDifferential Equation and Difference Equation

On successful completion of the course students should be able to,

1. Differential Equation of first order and first degree.
2. Differential equation of first order but not first degree.
3. Simultaneous differential equations.
4. Linear differential equation with constant coefficient.
5. Homogeneous linear differential equation OR Cauchy –Euler equation.
6. Wronskian and its properties.
7. Linear equation of second order.
8. Difference equation.

Paper –IV (MT 104) : Partial Differential Equation

On successful completion of the course students should be able to,

1. Partial Differential Equations, Lagrange's Linear Equations.
2. Linear Partial Differential Equations.
3. Non Linear Partial Differential Equations.
4. Second order Partial Differential Equations .

Paper -V (MT 201): Real Analysis - I

On successful completion of the course students should be able to:

1. Define and recognize basic properties of the field of real numbers that lead to thenformal
2. development of real analysis;
3. 2.Explain the sets of real numbers, their properties, operations on them;
4. Construct Reimann integral and all its properties;
5. Define Reimann sums and Reimanninegrable functions;
6. State and prove conditions of integrability, Darboux's Theorem
7. 4.Complete metric space;
5. Define and recognize the sequence of real numbers and its convergence;
6. Define and recognize Cauchy sequence and its Properties;
7. Define and recognize series of real numbers and its convergence;
8. Use Leibnitz rule for convergence of alternating series;
9. Apply different tests for convergence of series of real numbers;
10. Understand the Fundamental Theorem of Calculus and use it in examples

Paper –VI (MT 202):Set Theory and Laplace Transform

On successful completion of the course students should be able to,

1. Set theory.
2. Fuzzy Set.
3. Laplace Transforms.
4. Inverse Laplace Transforms.

Paper – VII (MT 203): Algebra

On successful completion of the course students should be able to,

1. Group Theory
2. Subgroups, Normal Subgroups and Quotient Groups
3. Homomorphisms, Automorphisms of Groups, Permutation Groups
4. Ring Theory and Field

Paper –VIII (MT 204):Elementary Number Theory

On successful completion of the course students should be able to,

1. Division Algorithm,Euclidean Algorithm.
2. Least Common Multiple.
3. Prime number, fermat number.
4. Congruence, spatial divisibility test.
5. Chinese remainder theorem, goldbach conjuncture.
6. Arithmetic function, Eulers theorem.
7. Pythagorean triplets.

Paper –IX (MT 301):Linear algebra

On successful completion of the course students should be able to,

1. Vector space: definition of vector space and examples.
2. Linear dependence and linear independence.
3. Linear transformation, the algebra of linear transformation.
4. Rank nullity of matrix, Isomorphism.
5. Inner product space, Cauchy Schwartz inequality.
6. Dual space, Bi dual space and natural isomorphism.
7. Adjoint of a linear transform.
8. Gram-Schmidt orthogonalization process, orthogonal compliment.
9. Inner product space.
10. Eigen values and Eigen vectors of a linear transform.

Paper – X (MT 302): Special relativity-I

On successful completion of the course students should be able to,

1. Review of Newtonian mechanics, inertial system.
2. Galilean transformation, Newtonian relativity.
3. Conservation laws in Newtonian mechanics.
4. Einstein's special theory of relativity.
5. Relativistic kinematics-composition of parallel velocities.
6. The transformation equation for components of acceleration of a particle.
7. Geometrical representation of space time, time like, light like.
8. Proper time,world line of a particle.

Paper – XI (MT 303): Complex analysis and vector calculus

On successful completion of the course students should be able to,

1. Analytic function,Cauchy Riemann equation.
2. Polar form of Cauchy Riemann equation.
3. Complex integration,Cauchy's integral theorem.
4. Cauchy integral formula, singularity.
5. Vector differentiation, gradient,divergence.
6. Green,gauss and stokes theorems and problem based on these.

Paper – XII (MT 304): Special relativity-II

On successful completion of the course students should be able to,

1. Tensor analysis-coordinate transformation.
2. Summation convention,the kronecker delta.
3. Christoffels symbols, transformation of crystoffels symbols.
4. Relativistic mechanics: variation of mass with velocity equivalence of mass & energy.
5. Electromagnetism: Maxwell's equation in vacuum,
6. The electromagnetic field tensor Maxwell's eqn. in tensor form.

Course No. - I

Name of the course: Differential and Integral Calculus

Unit –I

Limit and continuity (ε and δ definition). Types of discontinuities, theorems on limit and continuity. Differentiability of functions, successive differentiation, Leibnitz's theorem.

Unit –II

Mean Value theorem, Roll's theorem, Cauchy's generalized mean value theorem, Lagrange's mean value theorem, Taylors theorem with Lagrange's &Cauchy's form of remainder, Maclaurins Series &Taylors Series of sin x , cos x ,
ex ,log (1+ x), (1+ x)m

Unit –III

Improper integral Gamma function properties of Gamma function , Beta function , Properties of Beta function Indeterminate forms L' Hospitals rule.

Unit –IV

Double integration, properties of double integration, Iterated integral, Change of order integration, Transformation of Double integral in polar form.

Course No. - II

Name of the course: Differential Calculus and Trigonometry

Unit –I

Limit and continuity of functions of two variables, Partial Differentiation, Differential, and Chain rule.

Unit –II

Homogeneous function, Euler's theorem, Jacobian , Maxima & minima, Lagrange's Multiplier method ,Taylor's theorem for function of two variables.

Unit –III

Tangent & normal, curvature asymptotes singular points, tracing of curve parametric representation of curve, tracing of curve in Cartesian form.

Unit –IV

De Moivre's theorem & its application , square root of complex number, inverse circular & hyperbolic functions , logarithm of complex quantity, summation of series. C+iS Method .

Course No. -III

Name of the course: Ordinary Differential Equation and Difference Equation

Unit –I

First order exact differential equation, integrating factor, rules to find an integrating factors , Linear equation , Bernoulli's equation, First order higher degree equations solvable for x,y,p, Orthogonal Trajectory.

Unit –II

Simultaneous differential equations, Linear equation with constant coefficients complementary function operator to find the Particular integral.

Unit –III

Linear equation with Variable coefficient Cauchy's Euler's homogeneous Linear differential equation , Wronskian & its properties , method of variation of parameter .

Unit –IV

Formation of Difference equation . Order of difference equation .Liner difference equation. Homogeneous linear equation with constant coefficient . Non homogeneous linear equation Particular integrals.

Course No. - IV

Name of the course:Partial differential equations

Unit –I

Linear partial differential equation of first order . Formation partial differential equation by eliminating the arbitrary constant and arbitrary function .Total differential equation Lagrange's linear partial differential equation.

Unit –II

Compatible Differential Equations. Condition of Compatibility . Non linear partial differential equations.
Type I f(p,q)=0
Type II Z=px+qy+f(p,q)
Type III F(z,p,q) =0
Type IV F(x,p)= G(y,q)
Charpit's method

Unit –III

Homogeneous partial differential equation with constant coefficient solution of partial differential equation complementary function and particular integral, Jacobbi's method.

Unit –IV

Non- Homogeneous linear partial differential equation, Equation reducible to linear . partial differential equation . with constant coefficient classification of second order partial differential equation.

Course No.-V

Name of the course: Real Analysis - I

Unit-I

Real sequence, bounded sequence, Cauchy convergence criterion for sequences, Cauchy's theorem on limits, monotone sequences and their convergence, monotone convergence theorem.

Unit – II

Infinite series, Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test, test for convergence.

Unit – III

Metric, Neighbourhood, closed sets, open sets, bounded sets, DeMorgan's law, definition of metric space, subspace of metric space, open sphere, closed sphere, Cauchy sequence, complete metric space.

Unit-IV

Riemann integral, Darboux's upper and lower sums, lower and upper integrals, Riemann integral, criterion for Riemann integrability, properties of integrable functions, integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorem of integral calculus.

Course No. -VI

Name of the course: Set Theory and Laplace Transform

Unit-I

Sets, subsets, basic set operations, Venn diagrams, finite and infinite sets, classes of sets, power of a set, countable and uncountable sets, basic sets of numbers, set of real numbers R, real line, supremum and infimum, completeness property of R, Archimedean property of R, Cartesian products of two sets, relations, types of relations, equivalence relation.

Unit-II

Basic concepts of Fuzzy sets, examples of fuzzy sets, operations on fuzzy sets: intersection, union and complements of fuzzy sets, alpha cuts and convex fuzzy sets, normal fuzzy sets.

Unit-III

Laplace transform, existence theorem for Laplace transform, linearity of Laplace transform, shifting theorem, Laplace transform of derivatives and integrals.

Unit-IV

Inverse Laplace transform, convolution theorem, solution of differential equations and partial differential equations.

Course No. -VII

Name of the course: Algebra

Unit-I

Group: definition of a group with examples, properties of a group, subgroups, cyclic groups, order of a generator of a cyclic group, permutation groups, even and odd permutations.

Unit-II

Cosets and Normal Subgroups: cosets, Langrage's theorem, normal subgroups: their definition, examples, and characterizations, algebra of normal subgroups, quotient groups.

Unit – III

Homomorphism and Isomorphism: homomorphism, homomorphic image, kernel of homomorphism, isomorphism of a group, fundamental theorem on homomorphism of a group, Natural homomorphism, second isomorphism theorem, third isomorphism theorem .

Unit-IV

Ring, Integral domain and Field: definition, examples and properties of a ring (commutative ring, ring with unity, zero divisor, without zero divisor), subring, characterization of ring, integral domain, field.

Course No. - VIII

Name of the course: Elementary Number Theory

Unit-I

Divisibility, division algorithm, the greatest common divisor, greatest common divisor of more than two integers, Euclidean algorithm, least common multiple.

Unit- II

Prime numbers, the Fundamental theorem of arithmetic or unique factorization theorem, Fermat numbers, linear Diphantine equation.

Unit-III

Congruence, properties of congruence, special divisibility test, linear congruence, Chinese reminder theorem, Goldbach conjuncture

Unit-IV

Arithmetic function, Euler's theorem, Mobius □ function, the □ and □ functions, Pythagorean triplets.

Course No. - IX

Name of the course: Linear Algebra

Unit- I: Vector Space: Definition and example of vector spaces, subspace, linear span, Quotient space, Linear dependence and Independence and their basic properties, Basis and dimension.

Unit- II: Linear transformations: The algebra of linear transformation, Rank Nullity Theorem, Matrix and linear transformation, Rank Nullity of Matrix, Isomorphism.

Unit- III: Dual Space: Dual Space, Bi dual space and natural isomorphism. Adjoint of a linear transform, Eigen values and Eigen vectors of a linear transform.

Unit- IV: Inner product space: Inner product, Cauchy Schwartz inequality, orthogonalvectors,orthogonal compliment, Orthogonal set, Bessel's inequality for finite dimensional space, Gram –Schmidt Orthogonalisation process.

Course No. -X

Name of the course: Special Relativity -I

Unit –I: Review of Newtonian mechanics, Inertial system , Galilean transformation, Newtonian relativity, Conservation laws in Newtonian mechanics , Maxwell's electromagnetic theory , Michelson – Morley experiment, Lorentz Fitzgerald contraction hypothesis, relative character of space and time

Unit – II: Einstein's special theory of relativity, postulates of special relativity theory, Lorentz transformation, Geometrical interpretation of Lorentz transformation , Group properties of Lorentz transformation , Length contraction, Time dilation.

Unit – III:Relativistic Kinematics- Composition of parallel velocities , transformation equations for componets of velocity, addition law for velocity, transformation of Lorentz contraction factor $(1- v^2/c^2)^{1/2}$, The transformation equation for components of acceleration of a particle.

Unit – IV: Geometrical representation of space time , Four dimensional Minkowskian space time of special relativity, Time like , Light like , and Space like inteervals , Lorentz transformation in index form , Proper time , world line of a particle , Four vectors and Four tensors in Minkowskin space time

Course No. - XI

Name of the course: Complex Analysis & Vector Calculus

Unit- I:Analytic function, Cauchy Riemann Equation, Polar form of Cauchy Riemann Equation, Harmonic functions, Mobius Transformation, Cross Ratio.

Unit- II: ComplexIntegration, Cauchy's Integral Theorem, Cauchy's Integral Formula, Singularity, Residue Theorem.

Unit- III: Vector Differentiation,Gradient,Divergence, Curle and Vector Integration.

Unit- IV: Green, Gauss and Stokes Theorems and Problem based on these.

Course No. - XII

Name of the course: Special Relativity -II

UNIT – I:

Tensor Analysis – Coordinate transformations, Summation Convention, The Kronecker delta, Covariant, Contravariant and mixed tensor, symmetric and skew symmetric tensors, Fundamental operations on tensors, metric tensor, conjugate metric tensor.

UNIT – II:

Christoffels symbols, Transformation of christoffels symbols, covariant derivatives, Absolute derivative, Geodesics, Curvature tensor, Ricci tensor, Einstein tensor, The Bianchi identity.

UNIT – III:

Relativistic Mechanics : Variation of mass with velocity Equivalence of mass and energy, Transformation Eqn for mass, momentum and energy, Energy momentum four vectors, Relativistic force and transformation equation for its components, Relativistic Lagrangian and Hamiltonian Relativistic eqn of motion of particle.

UNIT – IV:

Electromagnetism : Maxwell's equation in vacuum, Transformation equations for density of electric charge and current, propagation of electric and magnetic field strength, Transformation equations for electromagnetic four potential vector, Lagrangian for a charged particle in an electromagnetic field. Lorentz force, The electromagnetic field tensor Maxwell's eqn in tensor form, Lorentz force on a charged particle.

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