

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

TNCF 2017 - DRAFT SYLLABUS

Subject :Mathematics

Class : XI

TOPIC	CONTENT
Unit 1 : Basic Algebra	Real Numbers - Revision : Rational, Irrational Numbers, Expressing inequalities like $x < 2$ or $x \geq 3$ using intervals; Absolute value of x; Exponents - Revision: Properties of exponents, Converting radicals/surds to exponents. Rationalizing fractions with surds; Polynomials - Addition, multiplication and factorisation of polynomials, Identities for $(x+a)(x+b)$, $(a \pm b)^2$, $(a \pm b)^3$, $(a+b)(a-b)$, $(a^3 \pm b^3)$, $(x^n - 1)$, Method of undetermined coefficients to find a polynomial of given degree; Rational Expressions - Simplification of rational expressions by factorization, Partial fractions: linear and quadratic factors; Graphs - Graphical representation of data, Interpreting a graph and answering questions based on it; Equations and simple inequalities roots of Linear Equations, quadratic equations, roots of a factored polynomial equation; solving equations with radicals and absolute value; solving simple linear inequalities, graphical representation of equations and inequalities

<p>Unit 2 :</p> <p>Sets , Relations and Functions</p>	<p>Sets - recalling: Definitions and Examples, types of sets, algebra of sets, De Morgan Laws, venn diagrams, practical problems; Intervals - open and closed intervals, other types of intervals, neighbourhood of a Point; Cartesian product of sets - definition and examples; Relations - special relations: reflexive, symmetric, transitive, anti-symmetric and equivalence relations; Functions and Graphs of Algebraic functions - functions as a formula, real valued functions, identity function, polynomial functions, rational functions, absolute value functions, Signum functions, greatest integer functions; Algebra of functions - addition, subtraction, multiplication and quotient of functions, composition of functions, one to one and onto functions, Inverse of a function</p>
<p>Unit 3 :</p> <p>Trigonometry</p>	<p>Basic concepts - angles, signs of an angle, degree and radian measures, trigonometric ratios for all angles, basic trigonometric identities; Formulae for sum of angles and sum and products of trigonometric ratios - formulae for $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$, $\sin 2A$, $\cos 2A$, $\tan 2A$, $\sin 3A$, $\cos 3A$, $\tan 3A$, sum and product formulae: $\sin C \pm \sin D$, $\cos C \pm \cos D$, $\sin A \cos B$, $\cos A \cos B$, $\sin A \sin B$; Trigonometric equations - general solutions of the trigonometric equations: $\sin \theta = \sin \alpha$, $\cos \theta = \cos \alpha$, $\tan \theta = \tan \alpha$, $a \cos \theta + b \sin \theta = c$; Properties of Triangles - sine and cosine rule: Projection and area formulae, application to triangles; Inverse trigonometric functions - definitions, Identities and simple problems</p>

<p>Unit 4 : Combinatorics</p>	<p>Factorials - definition and examples; Permutations - fundamental principle of counting, permutation of distinct objects, not all distinct objects, simple problems; Combinations - definition, relation between Permutation and combinations, properties, simple problems; Mathematical Induction - principles, simple problems</p>
<p>Unit 5 : Finite and Infinite Series</p>	<p>Binomial theorem - Binomial theorem for positive integral index (proof using combinations and also by induction), applications of binomial theorem; Sequence and Series - AP, GP, HP: Terms and Sum of AP and GP, Arithmetic and Geometric means. Problems on sum of finite series, Arithmetico-geometric progression. $\sum n, \sum n^2, \sum n^3$ and telescopic sums for series like $\sum \frac{1}{n(n+1)}$; Infinite Series - Infinite Geometric Series; Infinite Arithmetico - Geometric Series; Infinite series using principle of telescopic sums; Exponential and logarithmic series (without proof); Binomial theorem for all rational index as an infinite series (without proof)</p>
<p>Unit 6 : Two Dimensional Analytic geometry - I</p>	<p>Locus of a point - definition and simple examples; Straight lines - various forms of equation: Slope – point, Slope – intercept, two points, intercepts, normal and parametric forms; general form; related problems; Pair of Straight lines - equation of a pair of straight lines, problems related with: distance of a point from a line, distance between two parallel lines, equation of a line bisecting the angle between two lines</p>

<p>Unit 7 : Matrices and Determinants - I</p>	<p>Matrices - definition, concept and types of matrices, operations of transpose, scalar multiplication, multiplying a row or column by a number, adding two rows/columns, reducing a matrix into triangular and echelon form, addition and multiplication of matrices, solving simultaneous linear equations by Gaussian Elimination Method; Determinants - definition of a determinant and its evaluations, properties of determinants, using properties of determinants to evaluate the value, product of determinants, determinant of a square matrix, singular and non-singular matrices</p>
<p>Unit 8 : Vectors -I</p>	<p>Scalars and Vector - Concept of scalars and vectors, Magnitude and direction of a general vector, free vectors, localized vectors, zero vector, unit vector, negative of a vector, algebra of vectors, resolution of a vector, vector Arithmetic in space (3D) using $\vec{i}, \vec{j}, \vec{k}$, direction ratios and direction cosines; Vector Algebra - equality of vectors, collinear vectors, co-planar vectors, co-initial vectors, like vectors, unlike vectors, triangle law, parallelogram law, Polygon law; Applications of Vector Algebra - position vector of a point, distinction between position vectors and free vectors, section formulae, problems; Product of two vectors - angle between two vectors, definition of dot product, geometrical meaning, properties, definition of cross product, geometrical meaning, properties, applications to geometry, trigonometry and physics</p>
<p>Unit 9 : Limits, Continuity</p>	<p>Limits - approximations and errors, intuitive understanding of limit as an extension of approximation,</p>

<p>y and Differentiability</p>	<p>Left hand limits and Right hand limits, definition of Limit, properties of limit, Limit theorems, Standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$, $\lim_{x \rightarrow 0} \frac{\log(x+1)}{x}$, Evaluation of limits; Continuity - graphical meaning of continuity of a function, visual identification of continuity and discontinuity, formal definition of continuity, examples, points of discontinuity, kinds of discontinuity, algebra of continuous functions, composite function theorem, standard problems; Slope as Limits - finding the slope of straight lines and curves, definition of a derivative as limit, evaluation of simple derivatives; Differentiability - graphical understanding of differentiability and non-differentiability, formal definition of differentiability and examples, relation between continuity and differentiability, evaluation of derivatives using first principle, properties of derivatives, derivatives as a rate of change, slope of a straight line</p>
<p>Unit 10 : Differential Calculus</p>	<p>Methods of differentiation - differentiation formulae: addition, product, quotient rules, derivative of composite functions, power functions, trigonometric functions, derivative of implicit functions, parametric differentiation, meaning of second, third and higher order derivatives (with problems restricted to second order), differentiation of functions with respect to another functions</p>

Unit 11 : Integral Calculus	Indefinite integral as Anti-derivative - integration as anti-derivative, properties of integrals and integrals of standard functions and also functions of the form $\sqrt{a^2 - x^2}$, $\sqrt{x^2 \pm a^2}$, $\frac{1}{a^2+x^2}$, $\frac{1}{\sqrt{a^2-x^2}}$, $\frac{1}{\sqrt{x^2\pm a^2}}$; Methods of Integration - properties of integration, indefinite integrals: decomposition, substitution, partial fractions and integration by parts methods.
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TOPIC	CONTENT
Unit 1 : Matrices and determinants -II	Inverse of a Matrix - cofactor of a matrix, adjoint of a matrix, inverse of a matrix, uniqueness of inverse; Elementary Transformations - rank of a matrix, echelon form, inverse of a matrix using elementary transformations; System of linear equations - linear equations in matrix form, solving equations using Matrix Inverse method, consistency of the system of equations by Determinant method and Rank method
Unit 2 : Complex Numbers	Introduction to Complex Numbers - need for complex numbers; complex numbers as ordered pairs of real numbers; basic arithmetic operations on complex numbers; Algebra of complex numbers - conjugate of a complex number, modulus of a complex number, triangle inequality, problems; Polar form - argand plane as an extension of the real number line, geometrical representation of complex numbers, conjugate, modulus, addition and subtraction, polar form of a

	<p>complex number and principal value of the argument; Demoivre's theorem - statement of Demoivre's theorem, Euler's formula, notation and polar form of unit circle, square roots, cube roots and fourth roots of unity, problems involving the cube roots of unity</p>
<p>Unit 3 : Theory of Equations</p>	<p>3.1 Quadratic Equations - relation between roots and coefficients, conditions for rational, irrational and complex roots, solving equations reducible to quadratic equation, graph of a quadratic function, minimum and maximum values, quadratic inequalities and sign of quadratic expression; Polynomial equations - fundamental theorem of algebra, formation of equation for the given roots, equations with rational coefficients when some of the irrational or complex roots are given, roots of third or higher degree polynomial equations when given in partly factorised form; Graphical approach to equations - using continuity of polynomial functions to find real roots by finding where the function changes sign, counting the number of positive, negative and complex roots using Descartes' rule of signs (no proof)</p>

<p>Unit 4 : Trigonometric functions and Inverse Trigonometric functions</p>	<p>4.1 Periodic functions - definition and examples, domain and Range of a function; Odd and Even functions - definitions and examples; Graphs of Trigonometric functions - graphs of sine, cosine, tangent, secant, cosecant, cotangent functions; Properties and graphs of inverse Trigonometric functions - domain and Range of Inverse Trigonometric functions, properties of Inverse Trigonometric functions, Simple problems, graphs of Inverse of sine, cosine, tangent, secant, cosecant, cotangent functions</p>
<p>Unit 5 : Two Dimensional Analytic Geometry - II</p>	<p>5.1 Conic sections - definition of a conic, general equation of a conic, sections of a cone; Circle - general form, standard forms, parametric form, verifying position of a given point; Parabola - standard equation: four types, properties, parametric form, simple problems and applications; Ellipse and Hyperbola - standard equation, parametric form, properties, simple problems and applications</p>
<p>Unit 6 : Vectors - II</p>	<p>6.1 Scalar Triple Product - definition of scalar triple product, geometric meaning and determinant form , properties, problems and applications; Vector Triple Product - definition of vector triple product, geometric meaning,</p>

	<p>properties, problems and applications; Straight lines - vector and cartesian equations of a straight line: two points form, one point and parallel to a vector form, direction ratios and cosines, angle between two lines, coplanar lines (intersecting, perpendicular, parallel), non-coplanar lines, distance between two parallel lines, two non-coplanar lines, a point and a line; Planes - vector and cartesian equations of a plane (Normal form, given one point and two parallel vectors, given two points and one parallel vector, given three points, passing through intersection of two planes), angle between two planes, angle between a line and a plane, meeting point of a line and a plane, distance between a point and a plane, distance between two parallel planes</p>
<p>Unit 7 : Applications of Derivatives</p>	<p>7.1 Derivatives as Slope and Rate of Change - meaning of derivative as slope, equations of tangent and normal, meaning of derivative as rate of change and related rates; Mean Value Theorem - Rolle's theorem, Lagrange's Mean Value Theorem, geometrical meaning, applications; Indeterminate forms - a limit process - l' Hôpital Rul, evaluating the limits; Sketching of elementary curves - increasing /</p>

	<p>decreasing – first derivative test, concavity / convexity – second derivative test, Asymptotes and symmetry, sketching of polynomial, rational, trigonometric, exponential and logarithmic curves; Extrema of functions - Extrema: Maxima and Minima using first and second derivative test, applications to optimization</p>
<p>Unit 8 : Differentials and Partial Derivatives</p>	<p>8.1 Differentials - definition and simple problems; Errors and Approximations - types of errors – finding approximate values, concepts of differentials; Partial Differentiation - First order and second order partial derivatives, Function of function rule (two and three variables), simple problems</p>
<p>Unit 9 : Applications of integration</p>	<p>Evaluation of definite integrals - geometric meaning of definite integrals, definite integrals (Riemann integral) as a limit of sums, fundamental theorem of integral calculus, evaluation of definite integrals by evaluating the anti-derivative, reduction formulae, Bernoulli's formula, Gamma integral, properties of definite integrals; Areas and Volumes - area bounded by a curve and coordinate axes (simple problems), area bounded by two curves, volume of a solid obtained by revolving area about an axis (simple problems)</p>

<p>Unit 10 : Differential equations</p>	<p>10.1 Introduction to differential equations - definition of ordinary differential equations, order and degree of the ODE, general and particular solutions; Formation of differential equations - formation of differential equations by eliminating arbitrary constants (atmost two constants), Modeling problems of Population growth, Bacterial growth, Newton's law of cooling, Radio active decay; Solutions of linear differential equations (First order) - solutions of first order and first degree differential equations: variable separable method, homogenous differential equation, linear differential equations, applications to modelling: Solving the differential equations that were formed for population growth, bacterial colony growth, Newton's laws of cooling and radioactive decay</p>
<p>Unit 11 : Theory of Probability</p>	<p>11.1 Introduction to Probability - classical definition, random experiment, sample space and events, sure-impossible-mutually exclusive-exhaustive events; Laws on probability - addition and multiplication theorems, independent and dependent events, conditional and total probability, Bayes' theorem, simple problems; Probability distributions - introduction to random variables, probability mass function, probability density function, probability</p>

	distribution functions, probability, general distribution, mathematical expectation, Mean and Variance, binomial distribution
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