

APEAPCET 2023

ENGINEERING STREAM SYLLABUS

MATHEMATICS

ALGEBRA

- a) **Functions:** Types of functions – Definitions - Domain, Range.
- b) **Matrices:** Types of matrices - Scalar multiple of a matrix and multiplication of matrices - Transpose of a matrix – Determinants (excluding properties of determinants) - Adjoint and Inverse of a matrix - Rank of a matrix - Solution of simultaneous linear equations (Excluding Gauss Jordan Method).
- c) **Complex Numbers:** Complex number as an ordered pair of real numbers- fundamental operations - Representation of complex numbers in the form $a+ib$ - Modulus and amplitude of complex numbers–Illustrations - Geometrical and Polar Representation of complex numbers in Argand plane-Argand diagram.
- d) **De Moivre's Theorem:** De Moivre's theorem- Integral and Rational indices - n^{th} roots of unity- Geometrical Interpretations–Illustrations.
- e) **Quadratic Expressions:** Quadratic expressions, equations in one variable - Sign of quadratic expressions – Change in signs – Maximum and minimum values, Quadratic Inequalities.
- f) **Theory of Equations:** The relation between the roots and coefficients in an equation - Solving the equations when two or more roots of it are connected by certain relation - Equation with real coefficients, occurrence of complex roots in conjugate pairs and its consequences, Transformation of equations- Reciprocal equations.
- g) **Permutations and Combinations:** Fundamental Principle of counting – linear and circular permutations- Permutations of 'n' dissimilar things taken 'r' at a time - Permutations when repetitions allowed - Circular permutations - Permutations with constraint repetitions - Combinations-definitions, certain theorems.
- h) **Binomial Theorem:** Binomial theorem for positive integral index, Binomial theorem for rational Index (without proof). Approximations using Binomial theorem
- i) **Partial fractions:** Partial fractions of $f(x)/g(x)$ when $g(x)$ contains non-repeated linear factors - Partial fractions of $f(x)/g(x)$ where both $f(x)$ and $g(x)$ are polynomials and when $g(x)$ contains repeated and/or non-repeated linear factors - Partial fractions of $f(x)/g(x)$ when $g(x)$ contains irreducible factors.

TRIGONOMETRY

- a) **Trigonometric Ratios upto Transformations:** Graphs and Periodicity of Trigonometric functions - Trigonometric ratios and Compound angles - Trigonometric ratios of multiple and sub- multiple angles - Transformations - Sum and Product rules.
- b) **Hyperbolic Functions:** Definition of Hyperbolic Function – Graphs - Definition of Inverse Hyperbolic Functions – Graphs - Addition formulae of Hyperbolic Functions.
- c) **Properties of Triangles:** Relation between sides and angles of a Triangle - Sine, Cosine, Tangent and Projection rules- Half angle formulae and areas of a triangle–In-circle and Ex-circle of a Triangle (excluding problems related to heights and distances).

VECTOR ALGEBRA

- a) **Addition of Vectors:** Vectors as a triad of real numbers - Classification of vectors - Addition of vectors - Scalar multiplication - Angle between two non-zero vectors - Linear combination of vectors - Component of a vector in three dimensions - Vector equations of line and plane including their Cartesian equivalent forms.
- b) **Product of Vectors:** Scalar Product - Geometrical Interpretations - orthogonal projections - Properties of dot product - Expression of dot product in i, j, k system - Angle between two vectors - Geometrical Vector methods – Vector equations of plane in normal form-Angle between two planes- Vector product of two vectors and properties- Vector product in i, j, k system- Vector Areas .

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MEASURES OF DISPERSION AND PROBABILITY

- a) **Measures of Dispersion** - Range - Mean deviation - Variance and standard deviation of ungrouped/grouped data, coefficient of variation and analysis of frequency distribution with equal means but different variances.
- b) **Probability**: Random experiments and events - Classical definition of probability, Axiomatic approach and addition theorem of probability - Independent and dependent events - conditional probability- multiplication theorem and Baye's theorem.
- c) **Random Variables and Probability Distributions**: Random Variables - Theoretical discrete distributions – Binomial and Poisson Distributions.

COORDINATE GEOMETRY

- a) **Locus**: Definition of locus –Illustrations-To find equations of locus-Problems connected to it.
- b) **The Straight Line**: Revision of fundamental results - Straight line - Normal form – Illustrations - Straight line - Symmetric form - Straight line - Reduction into various forms - Intersection of two Straight Lines - Family of straight lines - Concurrent lines - Condition for Concurrent lines - Angle between two lines - Length of perpendicular from a point to a Line - Distance between two parallel lines - Concurrent lines - properties related to a triangle.
- c) **Pair of Straight lines**: Equations of pair of lines passing through origin - angle between a pair of lines - Condition for perpendicular and coincident lines, bisectors of angles - Pair of bisectors of angles (excluding proofs of all the theorems only) - Pair of lines - second degree general equation - Conditions for parallel lines - distance between them, Point of intersection of pair of lines - Homogenizing a second degree equation with a first degree equation in x and y.
- d) **Circle** : Equation of circle -standard form-centre and radius equation of a circle with a given line segment as diameter & equation of circle through three non collinear points - parametric equations of a circle - Position of a point in the plane of a circle – power of a point-definition of tangent-length of tangent - Position of a straight line in the plane of a circle-conditions for a line to be tangent – chord joining two points on a circle – equation of the tangent at a point on the circle- point of contact-equation of normal-Chord of contact-pole and polar-conjugate points and conjugate lines- equation of chord with given middle point, Relative position of two circles- circles touching each other externally, internally common tangents –centers of similitude- equation of pair of tangents from an external point.
- e) **System of circles**: Angle between two intersecting circles –condition for orthogonality - Radical axis of two circles- properties- Common chord and common tangent of two circles –radical centre - Intersection of a line and a Circle.
- f) **Parabola**: Conic sections –Parabola- equation of parabola in standard form-different forms of parabola- parametric equations, Equations of tangent and normal at a point on the parabola (Cartesian and Parametric)- conditions for straight line to be a tangent.
- g) **Ellipse**: Equation of ellipse in standard form- Parametric equations, Equation of tangent and normal at a point on the ellipse (Cartesian and parametric)- condition for a straight line to be a tangent.
- h) **Hyperbola**: Equation of hyperbola in standard form- Parametric equations - Equations of tangent and normal at a point on the hyperbola (Cartesian and parametric) - conditions for a straight line to be tangent-Asymptotes.
- i) **Three Dimensional Coordinates**: Coordinates - Section formulae - Centroid of a triangle and tetrahedron.
- j) **Direction Cosines and Direction Ratios**: Direction Cosines –Direction Ratios (Excluding angle between two lines).
- k) **Plane**: Cartesian equation of Plane –Simple Illustrations (Excluding angle between two planes).

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CALCULUS

- a) **Limits and Continuity:** Intervals and neighborhoods – Limits - Standard Limits–Continuity.
- b) **Differentiation:** Derivative of a function - Elementary Properties - Trigonometric, Inverse Trigonometric, Hyperbolic, Inverse Hyperbolic Function – Derivatives - Methods of Differentiation – Second Order Derivatives.
- c) **Applications of Derivatives:** Geometrical Interpretation of a derivative - Equations of tangents and normals - Angles between two curves and condition for orthogonality of curves - Increasing and decreasing functions - Maxima and Minima.
- d) **Integration:** Integration as the inverse process of differentiation- Standard forms -properties of integrals - Method of substitution- integration of Algebraic, exponential, logarithmic, trigonometric and inverse trigonometric functions - Integration by parts – Integration by partial fractions method – Reduction formulae.
- e) **Definite Integrals:** Definite Integral as the limit of sum, Interpretation of Definite Integral as an area. Fundamental theorem of Integral Calculus. Properties, Reduction formulae, Application of Definite integral to areas.
- f) **Differential equations:** Formation of differential equation-Degree and order of an ordinary differential equation - Solving differential equation by i) Variables separable method, ii) Homogeneous differential equation, iii) Non Homogeneous differential equation iv) Linear differential equations

