UG TRB Mathematics Syllabus

UNIT-1 ALGEBRA and TRIGONOMETRY

Polynomial Equations – Imaginary and Irrational Roots – Relation between Roots and Coefficients symmetric function of Roots in terms of coefficient- Transformation of equation – Reciprocal equation - Increase or Decrease the
roots of given equation – Removal of terms – Descartes's rule of signs – Approximate solution of roots of polynomial by
Horner's Method–Cardan's method of solution of cubic polynomials – Summation of series using Binomial – Exponential and Logarithmic series.
Symmetric – Skew symmetric, Hermitian – Skew Hermitian, Orthogonal Matrices, Unitary Matrices – Eigen
Values – Eigen Vectors – Cayley-Hamilton Theorem – Similar Matrices – Diagonalization of Matrices.
Prime Number, Composite Number, Decomposition of a Composite Number as a Product of primes uniquely –
Divisor of a positive Integer – Euler Function. Congruence Modulo n, Highest power of prime number p Contained in n! –
Application of Maxima and Minima – Prime and Composite numbers – Euler's function ($\bar{N}$) – Congruences – Fermat's,
Wilson's and Lagrange's theorems.
Expansions of Power of sinnX, cosnX, tannx – Summation by C + i S method, Telescopic Summation - Expansion
of sinx, cosx, tanx in terms of x - Sum of Roots of Trigonometric Equation, Formation of Equation With Trigonometric
Roots - Hyperbolic Functions – Relation Between Circular and Hyperbolic Function – Inverse Hyperbolic Function –
Logarithm of a complex number – Principal Value and General Values.

UNIT II DIFFERENTIAL CALCULUS, INTEGRAL CALCULUS and ANALYTICAL GEOMETRY

nth derivatives –Trigonometrical Transformations —- Leibnitz Theorem – Implicit functions – Partial Differentiation
– Maxima / Minima of a function of two variables – Lagrangian multiplier method - Radius of curvature in Cartesian and

Professor Academy

Polar forms – Angle between radius vector and tangent – Slope of tangent of a polar curve – p-r equations – Center of
Curvature – Evolutes, Envelopes –Asymptotes of Algebraic curves - Asymptotes by inspection – Intersection of a curve
with asymptotes.
Evaluation of Double and Triple integrals – Applications of Multiple Integrals in finding volumes, surface areas of
solids – Areas of curved surfaces – Jacobians – Transformation of Integrals using Jacobians – Indefinite integrals - Beta
and Gamma Functions and their properties – Evaluation of Integrals using Beta and Gamma Functions.
Pole and Polar – Conjugate points and Conjugate lines, Conjugate diameters - Polar Coordinates – General Polar
Equation of a Straight line – General Polar Equation of a Conic

UNIT-III DIFFERENTIAL EQUATIONS and LAPLACE TRANSFORMATIONS

Ordinary Differential Equations - Homogeneous Equations - Exact equations - Integrating Factors - Linear
equations - Reduction of order – Second order Linear differential equations – General solution of homogeneous
Equations – Homogeneous equation with constant coefficients – Method of undetermined coefficients – method of
Variation of Parameters - System of first order equations – Linear systems - Homogeneous linear systems with constant
coefficients.
Partial Differential Differential Equations - Formation of Partial Differential Differential Equations by eliminating
arbitrary constants and arbitrary functions. Solving PDEs: Complete integral - Singular integral - general integral -
Lagrange's equation Pp+Qq=R - Charpit's method and special types of first order equations.
Laplace transform of elementary functions – Laplace transforms of special functions like unit step function. Dirac
Delta function – Properties of Laplace Transformation and Laplace Transforms of derivatives and integrals – Evaluation
of integrals using Laplace transform - Initial value theorem - Final value theorem – Laplace transform of periodic
functions – Inverse Laplace transforms – Convolution theorem – Application of Laplace transformations in solving first

Professor Academy

and second order linear differential equations and simultaneous linear ordinary differential equations.

UNIT –IV VECTOR CALCULUS and FOURIER SERIES, FOURIER TRANSFORMS

Vector Differentiation – Velocity and Acceleration – Vector valued functions and Scalar potentials – Gradient –
Divergence – Curl – Directional Derivative – Unit normal to a surface – Laplacian double operator – Harmonic functions.
Vector Integration – Line Integral – Conservative force field – Determining Scalar Potential from a conservative
force field – Work done by a force – Surface Integral – Volume integral – Theorems of Gauss, Stokes, and Green
Fourier Series – Expansions of Periodic functions of period 2∧ - Expansion of even and odd functions – half range
series – Evaluation of Infinite Series using Fourier Series expansions – Fourier Transforms – Infinite Fourier Transform –
Fourier Sine and Cosine transforms – Simple properties of Fourier Transforms – Convolution Theorem – Parseval's
identity.

UNIT –V ALGEBRAIC STRUCTURES

Groups – Subgroups, cyclic Groups and properties of cyclic groups, Lagrange's Theorem – Counting Principles –
Normal subgroups, Quotient groups, Homomorphism, Automorphism, Cayley's theorem, Permutation groups – Rings –
Some special classes of Rings – Integral domain, Homomorphism of rings – Ideal and Quotient rings – Prime ideal,
Maximum Ideals –the field and quotients of an integral domain – Euclidean rings – Algebra of Linear transformation,
Characteristic roots, matrices, Canonical forms, Triangular Forms – Problems of converting Linear Transformation to
Matrices and vice-versa – Vector Space – Definition and examples – Linear dependence – Independence, Sub spaces
and Dual spaces – Inner product spaces.

Professor Academy

UNIT-VI REAL ANALYSIS

Sets – Countable and Uncountable sets – Real Number system R – Functions – Real Valued functions,
Equivalence and Countability – Infremum and Supremum of a subset of R – Bolzano-Weierstrass Theorem –
Sequences of real numbers – Convergent and Divergent Sequences – Monotone Sequences – Cauchy Sequences –
Limit Superior and Limit Inferior of a sequence – Sub Sequences – Infinite series – Alternating Series – Conditional
convergence and Absolute convergence – Tests of Absolute convergence – Continuity and Uniform Continuity of a real
valued function of a real variable – Limit of a function at a point – Coninuity and Differentiability of real valued functions –
Rolle's Theorem – Mean Value Theorems – Inverse function theorem, Taylor's Theorem with remainder forms – Power
series expansion – Riemann Integrability – Sequences and Series of Functions.
Metric spaces – Limits of a function at a point in metric spaces – functions continuous on a metric space – various
reformulations of continuity of a function in a metric space - open sets – closed sets – discontinuous functions on the real
line.

UNIT VII COMPLEX ANALYSIS

Algebra of Complex Numbers – Function of Complex Variable – Mappings, Limits – Theorems on Limits,
continuity, differentiability – Cauchy-Riemann Equations – Analytic Functions – Harmonic Function – Conformal mapping
– Mobius Transformations – Elementary Transformation – Bilinear Transformations – Cross ratio – Fixed points of
bilinear transformations – Special Bilinear transformations.
Contours – Contour Integrals – Anti Derivatives – Cauchy-Goursat Theorem- Power Series – Complex Integration
– Cauchy's theorem, Morera's theorem, Cauchy's Integral Formula – Liouville's Theorem – Maximum Modulus Principle
– Schwarz's Lemma – Taylor's series – Laurent's series – Calculus of Residues – Residue Theorem – Evaluation of
Integrals - Definite integrals of Trigonometric functions – Argument principle and Rouche's Theorem.

Professor Academy

UNIT VIII MECHANICS

Statics: Forces on a rigid body –Moment of a force – General motion of a rigid body – Equivalent system of forces
– Parallel Forces – Forces along the sides of Triangle Couples.
Resultant of several coplanar forces – Equation of line of action of the resultant – Equilibrium of rigid body under
three Coplanar forces – Reduction of Coplanar forces into single force and couples – Laws of friction, angle of friction,
Equilibrium of a body on a rough inclined plane acted on by several forces – Equilibrium of a uniform Homogeneous
string – Catenary – Suspension bridge – Centre of Gravity of uniform rigid bodies.
Dynamics: Velocity and Acceleration – Coplanar motion – Rectilinear motion under constant forces – Acceleration
and retardation thrust on a plane – Motion along a Vertical line under gravity – Motion along an inclined plane – motion of
connected particles – Newton's Laws of motion.
Work, Energy and power – Work – Conservative field of force – Power –Rectilinear motion under varying force
Simple Harmonic Motion (S.H.M) – S.H.M along a horizontal line – S.H.M along a Vertical line – Motion under gravity in a
resisting medium.
Path of a projectile – Particle projected on an inclined plane – Analysis of forces acting on particles and rigid
bodies on static equilibrium, equivalent systems of forces, friction, centroids and moments of inertia – Elastic Medium,
Impact – Impulsive force – Impact of sphere – Impact of two smooth spheres – Impact of two spheres of two smooth
sphere on a plane – oblique impact of two smooth spheres.
Circular motion – Conical Pendulum motion of a cyclist on circular path – Circular motion on a vertical plane –
relative rest in revolving cone – simple pendulum – Central Orbits – Conic as Centered Orbit – Moment of inertia

UNIT IX OPERATIONS RESEARCH

Linear Programming – Formulation – Graphical Solution – Simplex Method – Big –M method – Two phase
method – Duality – Primal dual relation – dual simplex method – revised simplex method – Sensitivity analysis –

Transportation Problem – Assignment Problem – Queuing Theory – Basic Concepts – Steady State analysis of M/M/1
and M/M/Systems with infinite and finite capacities.
PERT-and CPM – Project network diagram – Critical path – PERT computations-Inventory Models- Basic
Concept –EOQ Models – uniform Demand rate infinite and finite protection rate with no shortage – Classical newspaper
boy problem with discrete demand – purchase inventory model with one price brake – Game theory – Two person Zero –
Sum game with saddle point – without saddle point – Dominance – Solving 2xn or mx2 game by graphical method –
Integer programming – Branch and bound method

UNIT—X STATISTICS/PROBABILITY

Measures of central tendency – Measures of Dispersion – Moments – Skewness and Kurtosis – Correlation –
Rank Correlation – Regression – Regression line of x on y and y on x – Index Numbers – Consumer Price Index
numbers – Conversion of chain base Index Number into fixed base index numbers – Curve Fitting – Principle of Least
Squares – Fitting a straight line – Fitting a second degree parabola – Fitting of power curves – Theory of Attributes –
Attributes – Consistency of Data – Independence and Associate of data.
Theory of Probability – Sample Space – Axioms of Probability – Probability function – Laws of Addition –
Conditional Probability – Law of multiplication – Independent – Boole's Inequality – Bayes' Theorem – Random Variables
– Distribution function – Discrete and continuous random variables – Probability density functions – Mathematical
Expectation – Moment Generating Functions – Cumulates – Characteristic functions – Theoretical distributions –
Binomial, Poisson, Normal distributions – Properties and conditions of a normal curve – Test of significance of sample
and large samples – Z-test – Student's t-test – F-test – Chi square and contingency coefficient.

Professor Academy