# PG- ENTRANCE SYLLABUS FOR MATHEMATICS

1] Matrices

2] Sequences and Infinite Series

3] Groups

4] Complex Analysis

5] Laplace Transformation

6] Basic concepts of Graph Theory

7] Vector Analysis

8] Continuity and Differentiability

9] Successive Differentiation

10] Ordinary Differential Equation

11] Partial Differential Equation

12] Integral calculus

PG Co-ordinator
Dept. of U.G. & P.G. Studies in Mathematics
GOVT. DEGREE COLLEGE
KALABURAGI

**1] Matrices:**

Recapitulation of matrix algebra (Basic concepts), rank of a matrix, elementary operations, equivalent matrices, Elementary matrices, invariance of rank under elementary operations, Echelon and Normal form of a matrix, inverse of a non- singular matrix by elementary operations. System of m-linear equations in n unknowns, matrices associated with linear equation, criterion for existence of non-trivial solution of homogeneous and non-homogeneous system, criterion for uniqueness of solutions. Eigen values and Eigen vectors of square matrix- Cayley-Hamilton theorem - Applications.

**2] Sequences and Infinite Series:**

Bounded and Unbounded sequences, Convergent, divergent and oscillatory sequences, Monotonic Sequences, Theorems on sequences (Every convergent sequence has unique limit) , If $\{x_n\}$ converges to $l$ then $\{|x_n|\}$ converges to $|l|$, Every convergent sequence is bounded, Sum, Difference, Product and Quotient of two convergent sequences is convergent, $(1+1/n)^n$ sequence converges the limit $e$.

**Infinite Series:**

Series of non-negative terms, geometric and $p$- series, Comparison test, De-Alembert's Ratio test, Raabe's test and Cauchy's root test. Alternating series, Leibnitz's test (without proof), Summation of series : exponential, logarithmic and binomial series and related examples.

**3] Groups:**

Definition of Groups and Sub-group and properties, Necessary and sufficient condition for a sub-group, Order of an element, Classification of sub-groups (i) Cyclic sub-groups, (ii) Co-sets, (iii) normal sub-groups, Standard Theorems (Every cyclic group is abelian, Lagrange's theorem, Euler's theorem, Fermat's theorem, Necessary and sufficient condition for normal sub-group).

Homomorphism, Isomorphism, Kernel of homomarphism with examples

**4] Complex Analysis: Functions of Complex variable and Complex Integration:**

Limits, Continuity, Differentiability. Analytic functions, Cauchy-Riemann Equations (Necessary condition only), Polar form of C-R equations, Harmonic functions, Harmonic conjugate, Construction of analytic function by Milne-Thomson method and related examples.

Basic definitions, Cauchy's integral theorem with examples, Cauchy's integral formula, Evaluation of Contour Integrals by Cauchy's integral formula, Derivatives of analytic function (Statements only), Cauchy's Inequality, Liouville's theorem

Residue at a pole, Residue at a pole of order $m> 1$, Cauchy's Residue Theorem, Evaluation of Contour Integrals by using Cauchy's Residue Theorems.

**5] Laplace Transformation:**

Definition of LT, Linearity Property, Laplace Transform of some standard functions - Properties of Laplace transforms. First shifting property, second shifting property, Inverse Laplace Transformation, computation of inverse Laplace Transformation by Partial fractions.

**6] Basic concepts of Graph Theory:**

Introduction, graphs, finite and null graphs, loops, multi graphs, pseudo graph, simple graph, degree of a vertex, isolated and pendent vertices, connectedness and complete graphs, regular and complementary graphs, minimum and maximum degree, $\sum deg(v_i) = 2q$. The number of vertices of odd degree is even. Isomorphism, line and total graphs (definitions and examples

Sub-graphs, spanning and induced sub-graphs, walk, trial, path, cycle, the shortest path problems, bipartite graph. Characterization of bipartite graphs in terms of its cycles.

**7] Vector Analysis:**

Vector algebra, Scalar and vector triple product, Product of four vectors, Reciprocal vector.

**8] Continuity and Differentiability:**

Recapitulation of limits, continuity and bounds of functions infinite limit, limit of infinity, types of discontinuity. Algebra of continuous functions (Statement only). Properties of continuous functions (Statement only). Differentiability of functions including hyperbolic functions(with definition), Rolle's theorem, Lagrange's theorem and Cauchy's Mean value theorems. Taylor's theorem. Taylor's & Maclaurin's series. Indeterminate forms and L'Hospital Rule with proof and examples (6 forms).

**9] Successive Differentiation:** Recapitulation of differentiation, Successive Differentiation, standard formula for nth derivative of the functions $(ax+b)^n$, $\log(ax+b)$, $e^{ax}$. $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$, Leibnitz's theorem and applications.

**10] Ordinary Differential Equation:**

Differential equations of first order and higher degree: Equations solvable for p, x, y and Clairault's equations-General and singular solutions.

Higher order differential equations: Linear Differential Equation with constant coefficients, finding Complementary function and Particular integral (When RHS function is of the form $e^{ax}$, $x^n$, $\sin ax$, $\cos ax$, $e^{ax}V$, where $V$ is a function of $x$).

**11] Partial Differential Equation:**

Formation of partial differential equations, Lagrange's equation $Pp+Qq = R$, First order non-linear partial differential equations and finding their complete integral by reducing to standard forms $f(p,q)=0$, $f(p,q,z)=0$, $f(x,p)=g(y,q)$, Clairaut's form, Charpit's method (without proof).

**12] Integral Calculus**:

Integrals of algebraic, trigonometric, rational and irrational function .Definite integral , application of Integral Calculus.

PG Co-ordinator
Dept. of U.G. & P.G. Studies in Mathematics
GOVT. DEGREE COLLEGE
KALABURAGI