

**SYLLABUS FOR RECRUITMENT TO THE POST OF  
LECTURER (MATHEMATICS) UNDER  
HIGHER SECONDARY SCHOOL, 2015**

**SUBJECTS**

1. General English Paper- I ..... 100 Marks
  2. General English Paper- II ..... 100 Marks
  3. Technical Paper- I (*Objective Type*) ..... 200 Marks
  4. Technical Paper- II (*Objective Type*) ..... 200 Marks
  5. Technical Paper - III (*Objective Type*) ..... 200 Marks
- (A) *Technical* ..... 150 Marks
- (B) *Aptitude Test..* ..... 50 Marks

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**GENERAL ENGLISH PAPER - I** (3 hours duration)

ESSAY TYPE

**(Full Marks : 100)**

- (a) Essay Writing ..... 25 Marks
- (b) Précis Writing ..... 15 Marks
- (c) Letter Writing ..... 15 Marks
- (d) Idioms & Phrases ..... 14 Marks
- (e) Expansion of passages ..... 15 Marks
- (f) Comprehension of given passages ..... 16 Marks

**GENERAL ENGLISH PAPER - II** (2 hours duration)

OBJECTIVE TYPE (MCQ)

**(Full Marks : 100)**

- (a) Grammar : ..... 40 Marks  
*Parts of Speech, Nouns, Adjective, Verb, Adverb, Preposition, etc.*
- (b) Composition ..... 30 Marks
  - i) *Analysis of complex and compound sentences*
  - ii) *Transformation of sentences*
  - iii) *Synthesis of sentences*
- (c) Correct usage and vocabularies ..... 30 Marks

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**MATHEMATICS**  
**PAPER I**  
**200 Marks (2 hours duration)**

**A. CALCULUS (100 marks)**

*Functions and graphs* :  $\epsilon - \delta$  definition of limit, standard theorems on limits, continuity, L'Hospital's Rule (statements only with applications)

*Derivative* : Derivatives of real valued functions on intervals : definition; derivative as a rate of measure, derivative as the gradient of tangent; Rolle's theorem and its consequences.

*Anti-derivative* : examples of evaluation of integrals from the definition; statements with illustration of the following two results; fundamental theorem of integral calculus; differentiability of integrals of continuous functions; properties of definite integral, evaluation of integrals using these properties;

*Sequences of real numbers* : bounded sequence, convergent sequence, limit of a sequence, monotonic sequence; examples; infinite series of real numbers: partial sums, convergent series, comparison test, ratio test, Raabe's test.

Functions of two or three variables: limits, continuity, partial derivatives. Double integrals; change of order of integration; application in determination of area, volume (simple cases only).

**B. ORDINARY DIFFERENTIAL EQUATIONS (100 marks)**

Formulation of differential equations; Equations of first order and first degree, integrating factor; Orthogonal trajectory; Equations of first order but not of first degree, Clairaut's equation, singular solution.

Second and higher order linear equations with constant coefficients, complementary function, particular integral and general solution.

Second order linear equations with variable coefficients, Euler-Cauchy equation; Determination of complete solution when one solution is known using method of variation of parameters.

**MATHEMATICS**  
**PAPER II**  
**200 Marks (2 hours duration)**

**A. ALGEBRA (100 marks)**

Groups, subgroups, cyclic groups, cosets, Lagrange's Theorem, normal subgroups, quotient groups, homomorphism of groups, basic isomorphism theorems, permutation groups.

The study of roots of cubic, biquadratic equations. Relation between roots and coefficients of a polynomial; symmetrical function of roots; formation of equation with given roots. De Moivre's theorem - application to solution of equation, expansion of  $\cos n\theta$ ,  $\sin n\theta$  and  $\tan n\theta$ . Solution of a cubic equation by Cardan's method.

**B. VECTOR SPACE AND MATRICES (100 marks)**

Vector spaces over  $\mathbb{R}$  and  $\mathbb{C}$ , linear dependence and independence, subspaces, bases, dimension; Linear transformations, rank and nullity, matrix of a linear transformation.

Algebra of Matrices; Addition, Multiplication, Determinants of a Matrix, Properties of Determinants, Inverse of a Matrix, Cramer's rule.

Row and column reduction, Echelon form, congruence's and similarity; Rank of a matrix; Inverse of a matrix; Solution of system of linear equations; Eigenvalues and eigenvectors, characteristic polynomial, Cayley-Hamilton theorem, Symmetric, skew-symmetric, Hermitian, skew-Hermitian, orthogonal and unitary matrices and their eigenvalues.

**MATHEMATICS**  
**PAPER III**  
**200 Marks (2 hours duration)**

**A. ADVANCED ALGEBRA (100 marks)**

Basic properties of rings; characteristic of rings; finite integral domains; subrings; ideals: right, left and two-sided; generated by a subset, more specifically by a finite number of elements in a commutative ring with 1; principal ideals; examples of ideals prime ideals, maximal ideals in a commutative ring with 1; examples; quotient ring,  $\mathbb{Z}_n$  as a quotient ring, fields.

Ring homomorphisms; kernels; isomorphism; homomorphisms and isomorphism theorems including the correspondence theorem; determination of ideals in  $\mathbb{Z}_p$ ; divisibility in integral domains; units, associates, prime elements, irreducible elements, gcd, Euclidean domain, principal ideal domain, unique factorisation domains - definition, examples and basic results.

## **B. VECTORS AND GEOMETRY (100 marks)**

Addition, Subtraction and Products of Vectors and Simple applications to Geometry. Derivatives of scalar and vector products, tangential and normal components of acceleration. Directional derivatives, gradient of a scalar-valued function, tangent planes.

Space co-ordinates: rectangular, cartesian, cylindrical, spherical, angle between two planes; perpendicular distance of a point from a plane; bisectors of two planes; equations of straight lines in space; co-planarity of two straight lines; perpendicular distance of a point from a straight line; shortest distance between two straight lines in space

Sphere - plane section and its equation; sphere through a given circle; tangent plane; pole and polar plane; intersection of two spheres; radical plane; equation of a cone with a conic as a guiding curve.

## **C. APTITUDE TEST (50 Marks)**

### **(a) Numerical And Figurework Tests: (15 Marks)**

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series.

### **(b) Verbal Analysis And Vocabulary Tests: (15 Marks)**

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

### **(c) Visual And Spatial/3-D Ability Tests: (10 Marks)**

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

### **(d) Abstract Reasoning Tests: (10 Marks)**

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.

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