

Mathematics Syllabus

There is one paper of two and a half hours duration carrying 80 marks and Internal Assessment of 20 marks. The paper is divided into two sections: Section I (40 marks) and Section II (40 marks).

Section I consists of compulsory short answer questions. In Section II, you are required to answer four out of seven questions.

1. Commercial Mathematics

(i) Compound Interest

(a) Compound interest as a repeated Simple Interest computation with a growing Principal. Use of this in computing Amount over a period of 2 or 3-years.

(b) Use of formula $A = P(1 + r/100)^n$. Finding CI from the relation $CI = A - P$.

- Interest compounded half-yearly included.
- Using the formula to find one quantity given different combinations of A, P, r, n, CI and SI; difference between CI and SI type included.
- Rate of growth and depreciation.

Note: Paying back in equal installments, being given rate of interest and installment amount, not included.

(ii) Sales Tax and Value Added Tax

Computation of tax including problems involving discounts, list-price, profit, loss, basic/cost price including inverse cases.

(iii) Banking

(a) Savings Bank Accounts. Types of accounts. Idea of savings Bank Account, computation of interest for a series of months.

(b) Recurring Deposit Accounts: computation of interest using the formula:

$$SI = P \times [n(n+1)/2 \times 12] \times r/100$$

(iv) Shares and Dividends

(a) Face/Nominal Value, Market Value, Dividend, Rate of Dividend, Premium.

(b) Formulae

- $\text{Income} = \text{number of shares} \times \text{rate of dividend} \times \text{FV}$
- $\text{Return} = (\text{Income} / \text{Investment}) \times 100$.

Note: Brokerage and fractional shares not included

2. Algebra

(i) Linear Inequations

Linear Inequations in one unknown for $x \in \mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{R}$. Solving

- Algebraically and writing the solution in set notation form.
- Representation of solution on the number line.

(ii) Quadratic Equations

(a) Quadratic equations in one unknown. Solving by:

- Factorization.
- Formula.

(b) Nature of roots

- Two distinct real roots if $b^2 - 4ac > 0$
- Two equal real roots if $b^2 - 4ac = 0$
- No real roots if $b^2 - 4ac < 0$

(c) Solving problems.

(iii) Reflection

(a) Reflection of a point in a line: $x=0$, $y=0$, $x=a$, $y=a$, the origin.

(b) Reflection of a point in the origin.

(c) Invariant points.

(iv) Ratio and Proportion

(a) Duplicate, triplicate, sub-duplicate, sub-triplicate, compounded ratios.

(b) Continued proportion, mean proportion

(c) Componendo and dividendo, alternendo and invertendo properties.

(d) Direct applications.

(v) Factorization

(a) Factor Theorem.

(b) Remainder Theorem.

(c) Factorizing a polynomial completely after obtaining one factor by factor theorem. Note: $f(x)$ not to exceed degree 3.

(vi) Matrices

(a) Order of a matrix. Row and column matrices.

(b) Compatibility for addition and multiplication.

(c) Null and Identity matrices.

(d) Addition and subtraction of 2×2 matrices.

(e) Multiplication of a 2×2 matrix by

- a non-zero rational number
- a matrix

(vii) Co-ordinate Geometry

Co-ordinates expressed as (x,y) Distance between two points, section, and Midpoint formula, Concept of slope, equation of a line, Various forms of straight lines.

(a) Distance formula.

(b) Section and Mid-point formula (Internal section only, co-ordinates of the centroid of a triangle included).

(c) Equation of a line:

- Slope-intercept form $y = mx + c$
- Two-point form $(y - y_1) = m(x - x_1)$

Geometric understanding of ' m ' as slope/ gradient/ $\tan\theta$ where θ is the angle the line makes with the positive direction of the x axis.

Geometric understanding of c as the y -intercept/ the ordinate of the point where the line intercepts the y axis/ the point on the line where $x=0$.

Conditions for two lines to be parallel or perpendicular. Simple applications of all of the above.

3. Geometry

(i) Symmetry

(a) Lines of symmetry of an isosceles triangle, equilateral triangle, rhombus, square, rectangle, pentagon, hexagon, octagon (all regular) and diamond shaped figure.

(b) Being given a figure, to draw its lines of symmetry. Being given part of one of the figures listed above to draw the rest of the figure based on the given lines of symmetry (neat recognizable free hand sketches acceptable).

(ii) Similarity

Axioms of similarity of triangles. Basic theorem of proportionality.

(a) Areas of similar triangles are proportional to the squares on corresponding sides.

(b) Direct applications based on the above including applications to maps and models.

(iii) Loci

Loci: Definition, meaning, Theorems based on Loci.

(a) The locus of a point equidistant from a fixed point is a circle with the fixed point as centre.

(b) The locus of a point equidistant from two intersecting lines is the bisector of the angles between the lines.

(c) The locus of a point equidistant from two given points is the perpendicular bisector of the line joining the points.

(iv) Circles

(a) Chord Properties:

- A straight line drawn from the center of a circle to bisect a chord which is not a diameter is at right angles to the chord.
- The perpendicular to a chord from the center bisects the chord (without proof).
- Equal chords are equidistant from the center.
- Chords equidistant from the center are equal (without proof).
- There is one and only one circle that passes through three given points not in a straight line.

(b) Arc and chord properties:

- The angle that an arc of a circle subtends at the center is double that which it subtends at any point on the remaining part of the circle.
- Angles in the same segment of a circle are equal (without proof).
- Angle in a semi-circle is a right angle.
- If two arcs subtend equal angles at the center, they are equal, and its converse.
- If two chords are equal, they cut off equal arcs, and its converse (without proof).
- If two chords intersect internally or externally then the product of the lengths of the segments are equal.

(c) Cyclic Properties:

- Opposite angles of a cyclic quadrilateral are supplementary.
- The exterior angle of a cyclic quadrilateral is equal to the opposite interior angle (without proof).

(d) Tangent Properties:

- The tangent at any point of a circle and the radius through the point are perpendicular to each other.
- If two circles touch, the point of contact lies on the straight line joining their centers.
- From any point outside a circle two tangents can be drawn and they are equal in length.
- If a chord and a tangent intersect externally, then the product of the lengths of segments of the chord is equal to the square of the length of the tangent from the point of contact to the point of intersection.
- If a line touches a circle and from the point of contact, a chord is drawn, the angles between the tangent and the chord are respectively equal to the angles in the corresponding alternate segments.

Note: Proofs of the theorems given above are to be taught unless specified otherwise.

(v) Constructions

(a) Construction of tangents to a circle from an external point.

(b) Circumscribing and inscribing a circle on a triangle and a regular hexagon.

4. Mensuration

Area and circumference of circle, Area and volume of solids – cone, sphere.

(a) Circle: Area and Circumference. Direct application problems including Inner and Outer area.

(b) Three-dimensional solids - right circular cone and sphere: Area (total surface and curved surface) and Volume. Direct application problems including cost, Inner and Outer volume and melting and recasting method to find the volume or surface area of a new solid. Combination of two solids included.

Note: Frustum is not included. Areas of sectors of circles other than quarter circle and semicircle are not included.

5. Trigonometry

(a) Using Identities to solve/prove simple algebraic trigonometric expressions

- $\sin^2 A + \cos^2 A = 1$
- $1 + \tan^2 A = \sec^2 A$

- $1 + \cot^2 A = \operatorname{cosec}^2 A$; $0 \leq A \leq 90^\circ$

(b) Trigonometric ratios of complementary angles and direct application:

- $\sin A = \cos(90 - A)$, $\cos A = \sin(90 - A)$
- $\tan A = \cot(90 - A)$, $\cot A = \tan(90 - A)$
- $\sec A = \operatorname{cosec}(90 - A)$, $\operatorname{cosec} A = \sec(90 - A)$

(c) Heights and distances: Solving 2-D problems involving angles of elevation and depression using trigonometric tables.

Note: Cases involving more than two right angled triangles excluded.

6. Statistics

Statistics - basic concepts, , Histograms and Ogive, Mean, Median, Mode.

(a) Graphical Representation. Histograms and ogives.

- Finding the mode from the histogram, the upper quartile, lower Quartile and median from the ogive.
- Calculation of inter Quartile range.

(b) Computation of:

- Measures of Central Tendency: Mean, median, mode for raw and arrayed data. Mean*, median class and modal class for grouped data. (both continuous and discontinuous).
- *Mean by all 3 methods included: Direct, Short-cut, Step-deviation.

7. Probability

- Random experiments
- Sample space
- Events
- Definition of probability
- Simple problems on single events

(tossing of one or two coins, throwing a die and selecting a student from a group)