CMI M.SC (MATHS) ENTRANCE EXAM SYLLABUS

Important note

The syllabus includes topics for PhD entrants too and so contains material which may often be found only in MSc courses and not BSc courses in the country. Our policy generally has been to have a common question paper for MSc and PhD levels but have separate cut-offs for them.

The Syllabus

Algebra.

(a) Groups, homomorphisms, cosets, Lagrange's Theorem, group actions, Sylow Theorems, symmetric group S_n, conjugacy class, rings, ideals, quotient by ideals, maximal and prime ideals, fields, algebraic extensions, finite fields

(b) Matrices, determinants, vector spaces, linear transformations, span, linear independence, basis, dimension, rank of a matrix, characteristic polynomial, eigenvalues, eigenvectors, upper triangulation, diagonalization, nilpotent matrices, scalar (dot) products, angle, rotations, orthogonal matrices, GL_n, SL_n, O_n, SO_2, SO_3.

References:

(i) *Algebra*, M. Artin
(ii) *Topics in Algebra*, Herstein
(iii) *Basic Algebra*, Jacobson
(iv) *Abstract Algebra*, Dummit and Foote

Complex Analysis.

Holomorphic functions, Cauchy-Riemann equations, integration, zeroes of analytic functions, Cauchy formulas, maximum modulus theorem, open mapping theorem, Louville's theorem, poles and singularities, residues and contour integration, conformal maps, Rouche's theorem, Morera's theorem

References:

(i) *Functions of one complex variable*, John Conway
(ii) *Complex Analysis*, L V Ahlfors
(iii) *Complex Analysis*, J Bak and D J Newman

Calculus and Real Analysis.

(a) Real Line: Limits, continuity, differentiablity, Reimann integration, sequences, series, limsup, liminf, pointwise and uniform convergence, uniform continuity, Taylor expansions,

(b) Multivariable: Limits, continuity, partial derivatives, chain rule, directional derivatives, total derivative, Jacobian, gradient, line integrals, surface integrals, vector fields, curl, divergence, Stoke's theorem

(c) General: Metric spaces, Heine Borel theorem, Cauchy sequences, completeness, Weierstrass approximation.

References:

(i) *Principles of mathematical analysis*, Rudin
(ii) *Real Analysis*, Royden
(iii) *Calculus*, Apostol

Topology. Topological spaces, base of open sets, product topology, accumulation points, boundary, continuity, connectedness, path connectedness, compactness, Hausdorff spaces, normal spaces, Urysohn's lemma, Tietze extension, Tychonoff's theorem,

References: *Topology*, James Munkres