

## Department of Mathematics

May 2nd, 2017

*Short-listing criteria for PhD Program for Academic Year 2017-18*

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- ✓ The short-listing criteria for written screening test are attached below.
- ✓ Shortlisted applicants (regular and part time) will be intimated online and they have to appear in a Written Screening Test to be held on Tuesday, 16-05-2017, from 9:00-10:00 am.
- ✓ The written screening test will comprise of 15 multiple choice questions.
- ✓ The syllabus of the written test is given below.
- ✓ The eligible applicants are requested to report for the written screening test on 16-05-2017 by 8:30 am in HoD office of Mathematics Department, IIT Delhi.
- ✓ The venue of the exam will be announced on Department web page.
- ✓ The top 25% in each category (GEN, OBC, SC, ST, PH) will then be shortlisted for interview.
- ✓ Ph.D. interview for 1<sup>st</sup> Semester 2017–2018 will be held on 16, 17 & 18-05-2017.
- ✓ Final selection to the PhD admission will be based only on the performance of the candidate in the interview.
- ✓ Any applicant who fulfils the short listing criteria and did not get a letter for the written screening test, may seek clarification by sending an e-mail to [hkumar@maths.iitd.ac.in](mailto:hkumar@maths.iitd.ac.in) by sending his name and application number.

### **Ph.D. Written Screening Test Syllabus**

Vector Spaces over fields of rational, real and complex numbers, subspaces, linear independence, linear span of a set of vectors, basis and dimension of a vector space, sum and direct sum, system of linear (homogeneous and non-homogeneous) equations, matrices and Gauss elimination, elementary row operations, row space, column space, null space and rank of a matrix.

Linear transformation, rank-nullity theorem and its applications, matrix representation of a linear transformation, changes of basis and similarity, eigenvalues and eigenvectors, characteristic and minimal polynomials, Cayley Hamilton theorem and applications, diagonalization.

Inner product spaces over fields of real and complex numbers, Gram-Schmidt orthogonalization process, orthogonal projection.

Elementary set theory, countable and uncountable sets, definition of a real number, Archimedean property, sequences of real numbers, limit superior and limit inferior, Cauchy sequence, convergence, Bolzano-Weierstrass theorem, series of real numbers, convergence.

Functions of one and several variables, limits, continuity and differentiability, Taylor's theorem, Taylor's series, inverse function theorem, implicit Function theorem, open sets, closed sets in reals, compactness, connectedness in reals, uniform continuity and the mean value theorems for real valued functions, maxima and minima, Riemann integral, fundamental theorem, improper integrals.