



**COMPUTER SCIENCE ENGINEERING DEPARTMENT**  
**Syllabus for Written Test to Ph. D Programme, August 2017.**

**Group A: (30 Marks: MCQ)**

**1) Probability and Statistics**

Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**2) Linear Algebra**

Matrix algebra, Systems of linear equations, Eigenvalues and eigenvectors.

**3) Discrete Mathematics**

Basic operations on sets, cartesian products, disjoint union (sum), power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses. Complete partial ordering, chain, lattice: complete, distributive, modular, and complemented lattices. Boolean and pseudo boolean lattices. Error correcting codes.

**4) Logical Reasoning, Data Analysis & Interpretation and Verbal Ability**

Number Sequence Completion, Pattern Completion, Sets based on grouping and patterns, Seating Arrangement problems, Circular Arrangements, Relational problems, Selection and Conditionals, Mapping and best routes, Miscellaneous sets consisting of formal logic, testing, sports events and other critical reasoning, Data Analysis, Data Interpretation, Data Sufficiency, Reading Comprehension, Verbal Logic, Vocabulary, Grammar Correction.

**Group B: (40 Marks: MCQ)**

**This section will cover fundamentals from B. Tech Syllabus in Computer Science Engineering.**

**Group C: (30 Marks: Descriptive)**

**Candidate is required to answer one of the groups. However, his/her selection may not be limited to that specialization only.**

**Specialization: Digital Logic Design**

Representation of signed and unsigned binary numbers.

**Logic circuits and minimization** - algebraic method, Karnaugh map, and Quine-McCluskey methods.



**Logic design using functional blocks** - multiplexers, encoders, decoders, memory.

**Flip-flops** - SR, JK, T and D, master-slave and edge-triggered. Design of finite-state machines. Design of counters and shift registers.

**Specialization: Image Analysis, Biometrics, Computer Vision**

Fundamentals of Image Formation, Transformations, Convolution and Filtering, Histogram Processing; Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing; Binarization and Segmentation; Detection of edges and lines in 2D images; Hough transform for detecting lines and curves.

Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem; Directed graphs: directed paths and cycles, connectivity and strongly connected digraphs.

Computations on polygons: point inclusion problem, polygon filling, polygon intersection, clipping, polygonization of a point set, convex hull computation; triangulation of polygons; Transformations in 2D and 3D: translation, rotation, scaling, reflection, Projection.

**Specialization: Cloud Computing and Big Data**

Fundamentals of Virtualization, Distributed programming models, MapReduce programming model, Multi processor scheduling algorithms for HTC.

Optimization in engineering, linear programming, non-linear programming (constrained and unconstrained), dynamic programming, stochastic programming.

Basics of Data Science, basic concepts in statistics, machine learning algorithms, techniques in exploratory data analysis.