Syllabus of admission test for

Postgraduate Diploma in Statistical and Computational Genomics (PGDSCG)

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The Selection Test

The selection test for PGDSCG will consist of two parts:

• Test **DGA** (MCQ type) in the forenoon session.

• Test **DGB** (short answer type) in the afternoon session:

Test **DGB** will be a short-answer type paper. The **DGB** test will consist of two groups, namely the **Biology Group** and the **Non-Biology Group**. One question from **Statistics** will be common for all. The candidate will have to answer remaining questions from any one of the two groups. The detailed syllabi are given in the subsequent pages.

Syllabus for DGA (Forenoon Session, MCQ Type)

The **DGA** test will consist of 30 multiple-choice questions from the following topics (however, the number of questions from each topic may not be the same).

Analytical reasoning: Statement & Argument, Statement & Assumption, Statement & Conclusion, Cause & Effect, Coding-Decoding, Analysing logical flow and validity, Visualization & Interpretation, Analogies, Data insufficiency, Clocks & Calendars, Venn Diagram.

Basic Sciences: Cell types and structure, biomolecules (carbohydrate, fat, protein, nucleic acid), cell cycle; Mole and molar mass, ionic bond, bond parameters, covalent bond, hydrogen bond; elementary arithmetic, basic algebra; units and measurements.

Statistics: Data interpretation, measures of central tendency and dispersion, elementary probability.

Syllabus for DGB (Afternoon Session, Short Answer Type) Biology Group

The students will have to answer one question of 15 marks on *Statistics*, and any 5 questions, of 15 marks each, from the remaining topics of the *Biology Group*.

Statistics: Data interpretation, measures of central tendency and dispersion; Correlation and Regression; Binomial, Poisson and Normal Probability distributions; Test of significance, t-test; Chi-square goodness of fit test; basic nonparametric tests.

Cell Biology: Prokaryotic & eukaryotic cells; Nucleus and nuclear components; Cell division, cell cycle; Cellular compartments and function; Mitochondria and chloroplast; Cell signalling.

Biochemistry: Amino acids and proteins; Carbohydrates; Nucleotides and nucleic acids; Lipids; Vitamins; Hormones; Protein structure and functions, enzymes; Metabolism.

Molecular Biology: Discovery of DNA as genetic material; Structure & function of DNA, RNA; Replication, repair, recombination; Transcription; RNA processing; Translation; Genetic code; Gene regulation in Prokaryotes and Eukaryotes.

Genetics: Information transfer DNA-RNA-Protein; genotype & phenotype; Pseudogenes; Cell division; Mutation; Mendelian inheritance; Deviation from Mendelian inheritance, Linkage & Sex-linked inheritance; Gene expression and function; Human genetics & genetic disorders; Population genetics.

Epigenetics: DNA methylation, non-coding RNAs, chromatin remodelling, Histone modifications, role of epigenetics in human diseases.

Immunology: Immune system; B cell, T cell receptors and signalling; Antigens; Innate immunity; Cytokines and chemokine; The complement system; MHC, Antigen processing & presentation; T cell/B cell development, activation & differentiation; Adaptive immunity; Immunoglobulins; Antigen antibody reactions; Self Non-self-discrimination; Clonal selection.

Physiology and Pharmacology: Systems physiology; The importance of pharmacology in the study of physiological processes; Pharmacodynamics & Pharmacokinetics; Definition of drug, agonist and antagonist. Drug delivery, Drug reactivity.

Genetic Engineering and techniques: PCR, Gel electrophoresis, qPCR; Hybridization techniques; Protein DNA interaction; Antisense RNA; Cloning; Transformation & transfection.

Syllabus for DGB (Afternoon Session, Short Answer Type) Non-Biology Group

The students will have to answer one question of 15 marks on *Statistics*, and any 5 questions, of 15 marks each, from the remaining topics of the *Non-Biology Group*.

Statistics: Data interpretation, measures of central tendency and dispersion; Correlation and Regression; Binomial, Poisson and Normal Probability distributions; Test of significance, t-test; Chi-square goodness of fit test; basic nonparametric tests.

Logical Reasoning: Functions and relations, divisibility, congruences; Permutations and combinations; Binomial theorem; Recurrence relations.

Linear Algebra: System of linear equations, Determinant, Rank and Inverse of a Matrix, Vector space and Linear transformation, eigenvalues and eigenvectors of Matrices, properties of symmetric and idempotent matrices.

Discrete Probability Theory: Combinatorial probability, conditional probability, Bayes theorem; Expectation and variance of discrete random variables.

Calculus: Sequences and series; Convergence, limits, continuity; Differentiation and integration of functions; Maxima and minima.

Logic Design: Boolean variables and Boolean functions, Logical operators and truth tables, Canonical forms (SOP / POS), Conceptual idea of minimization (Karnaugh Maps)

Programming Concepts: Pseudocodes written with sequential, conditional, iterative, recursive constructs, basic idea of functions and function call

Data Structures: Array, stack, queue, linked list; Binary Tree; Graphs.

Design and Analysis of Algorithms: Asymptotic notation, searching, sorting, complexity analysis.

Mechanics: Gravitation; Moments of inertia and applications; Particle dynamics and laws of motion; Elasticity and friction.

Thermodynamics: Laws of thermodynamics (First, Second, and Third Laws); Heat engines, efficiency and Carnot cycle; Applications of thermodynamic.