**ACADEMIC SUBJECT: MATHEMATICS**

### Table 1: AS 1 Math Structure for BSc (Ed) (Primary 2 CS Track)
#### AS 1 Math Structure for BSc (Ed) (Secondary)

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Title</th>
<th>Course Category</th>
<th>No. of AUs</th>
<th>Pre-requisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AAM10A</td>
<td>Linear Algebra I</td>
<td>Core</td>
<td>3</td>
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<tr>
<td></td>
<td>AAM10B</td>
<td>Calculus I</td>
<td>Core</td>
<td>3</td>
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<tr>
<td></td>
<td>AAM10C</td>
<td>Finite Mathematics</td>
<td>Core</td>
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<tr>
<td></td>
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<td>AAM20B</td>
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<td>AAM20C</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>AAM20E</td>
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<td>AAM20G</td>
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<td>Stochastic Processes</td>
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Please refer to the NIE Portal for the list of courses offered by semesters.
Table 2: AS 1 Math Structure for BA/BSc (Ed) (Primary 3 CS Track)

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<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Title</th>
<th>Course Category</th>
<th>No. of AUs</th>
<th>Pre-requisites</th>
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<tr>
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<td>Core</td>
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<td>AAM33E</td>
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<td>AAM33G</td>
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<td>AAM33H</td>
<td>Statistics III</td>
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<td>AAM33J</td>
<td>Combinatorial Analysis</td>
<td>Pres</td>
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<td>Academic Exercise: Mathematics</td>
<td>Core</td>
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<td>Select any 1 elective</td>
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<td>AAM43A</td>
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<td>AAM43B</td>
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<td>AAM43C</td>
<td>Applied Statistics</td>
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<td>AAM43D</td>
<td>Techniques in Operations Research</td>
<td>Pres</td>
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<td></td>
<td>AAM43E</td>
<td>Mathematical Programming and Stochastic Processes</td>
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<td>AAM43G</td>
<td>Metric Spaces</td>
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<td>AAM43H</td>
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<td>Graph Theory</td>
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<td></td>
<td>AAM43K</td>
<td>Geometry</td>
<td>Pres</td>
<td>3</td>
<td>-</td>
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<tr>
<td></td>
<td>AAM43L</td>
<td>Advanced Mathematical Modelling</td>
<td>Pres</td>
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</table>

Total AUs for Degree: 42

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Table 3: AS2 Math Structure for BSc(Ed) (Secondary)

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Title</th>
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<td>1</td>
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<td></td>
<td>AAM10B</td>
<td>Calculus I</td>
<td>Core</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>AAM10C</td>
<td>Finite Mathematics</td>
<td>Core</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>AAM10D</td>
<td>Number Theory</td>
<td>Core</td>
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<td>Total AUs for Degree</td>
<td></td>
<td>12</td>
<td>-</td>
</tr>
</tbody>
</table>

Please refer to the NIE Portal for the list of courses offered by semesters.

AAM10A Linear Algebra I

Introduction to set theory. Linear systems and methods of solving linear systems. Matrix algebra, determinant function. Vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$, dot product, cross product and geometric applications. Euclidean $n$-space, linear transformations.

AAM10B Calculus I

Functions: domain, codomain, range, composition of functions, graphs. Limits and continuity. Differentiation and applications of differentiation. Integration and applications of integration.

AAM10C Finite Mathematics

AAM10D Number Theory


AAM20A Linear Algebra II


AAM20B Calculus II

Sequence and series. Power series. Partial derivatives for functions of two or more variables, differentiability and chain rules for functions of two variables, directional derivatives and gradients for functions of two variables, tangent planes and normal lines, maxima and minima of functions of two variables, generalization of the concepts to functions of more than two variables. Double integrals and triple integrals.
AAM20C Statistics I


AAM20D Computational Mathematics

Introduction to computational methods and computing tools. Use of computing techniques to solve problems in mathematics, science and other disciplines. Examples may be drawn from problems involving numerical solutions of equations in one variable, approximation of functions, solving systems of linear equations, and numerical simulations.

AAM20E Differential Equations

AAM20G Complex Analysis


AAM33A Special Topics in Mathematics I

This course aims to cover some selected topics in mathematics that are not included in the regular course offerings. The contents and pre-requisites of this course may vary.

AAM33C Statistics II

Hypothesis testing: one and two samples for means, proportions and variances. Confidence interval for ratio of two variances. Chi-square tests and contingency tables. Simple linear regression: least squares estimation and inference (including diagnostic checking).

AAM33D Real Analysis

Theorem. Riemann Integration. The Fundamental Theorem of Calculus.

AAM33E Modern Algebra


AAM33G Modelling with Differential Equations


AAM33H Statistics III

Analysis of variance: completely randomized design, randomized block design, factorial designs. Non-parametric tests including sign test, Wilcoxon tests, rank correlation test.
AAM33J Combinatorial Analysis

Combinatorial techniques in proving. The principle of Inclusion and Exclusion and the general principle of Inclusion and Exclusion. The generating function of a sequence of numbers.

AAM40A Academic Exercise: Mathematics

The Academic Exercise provides student teachers an opportunity to engage in independent learning and research under the guidance of an academic staff. It gives student teachers a chance to explore topics that may not be covered in the regular curriculum, and to investigate and solve mathematical problems related to those topics. This Academic Exercise enables student teachers to further hone their problem solving and communication skills.

AAM43A Special Topics in Mathematics II

This course aims to cover some selected advanced topics in mathematics that are not included in the regular course offerings. The contents and pre-requisites of this course may vary.

AAM43B Statistical Theory

Further univariate distributions. Bivariate distributions. Moment generating functions and proof of Central Limit Theorem. Sampling distributions: t-, F-, and chi-square distributions. Selected topics from estimation theory and hypothesis testing theory.
AAM43C Applied Statistics

Selected topics from multiple regression models, design of experiments.

AAM43D Techniques in Operations Research

Topics from the theory of networks: minimal spanning trees, shortest paths, maximal flows, critical path analysis. Topics from the advanced theory of networks: least cost flows, transportation problem, travelling salesman problem, dynamic programming.

AAM43E Mathematical Programming and Stochastic Processes

Selected topics from the theory of linear programming: the simplex algorithm, introduction to duality, sensitivity analysis, dual simplex algorithm, integer programming, non-linear programming. Selected topics from the theory of stochastic processes: queueing theory, probabilistic inventory models, project scheduling under uncertainty.

AAM43G Metric Spaces

AAM43H Galois Theory

Field extensions, simple, finite and algebraic extensions, constructions with straight-edge and compass, splitting fields, normal and separable extensions, primitive elements, finite fields, Galois groups, Galois extensions, The Fundamental Theorem of Galois Theory, solvability by radicals.

AAM43J Graph Theory

Graphs. Euler tours, Hamiltonian cycles, representations of graphs, isomorphisms of graphs, planar graphs. Trees and applications. Selected topics from:
Connectivity and matching: Hall’s theorem, transversals, Konig’s theorem, vertex and edge cuts, Menger’s theorem.
Colouring: vertex colouring, Brook’s theorem, chromatic polynomials, map colouring and the four colour problem, edge colouring, Vizing’s theorem.
Planarity: planar graphs, Kuratowski’s theorem, Euler’s formula, dual graphs.
Ramsey theory, extremal graphs.

AAM43K Geometry

The axiomatic approaches to various geometries, including finite geometries, Euclidean geometry, hyperbolic geometry and spherical geometry. Geometric transformations of the Euclidean plane, symmetries and isometries. Brief excursions to the classical projective geometry and the modern geometry of fractal.
AAM43L Advanced Mathematical Modelling

Introduction to partial differential equations (PDEs) and classification into elliptic, parabolic and hyperbolic PDEs. Analytical and numerical solutions of PDEs. Explicit and implicit finite difference techniques for time-dependent PDEs, such as the unsteady diffusion equation. Direct and iterative methods for solving systems of algebraic equations. Application of numerical techniques for solving PDEs to industrial problems.