GENERAL CERTIFICATE OF EDUCATION
(ADVANCED LEVEL)

Grades 12 and 13

MATHEMATICS

SYLLABUS

(Effective from 2009)

Department of Mathematics
Faculty of Science and Technology
National Institute of Education
Maharagama
SRI LANKA

GENERAL CERTIFICATE OF EDUCATION
(ADVANCED LEVEL)

Grades 12 and 13

MATHEMATICS

SYLLABUS

(Effective from 2009)

Department of Mathematics
Faculty of Science and Technology
National Institute of Education
Maharagama
SRI LANKA

1.0 INTRODUCTION

The aim of education is to turn out creative children who would suit the modern world. To achieve this, the school curriculum should be revised according to the needs of the time.

Thus, it had been decided to introduce a competency based syllabus in 2009. The earlier revision of the G. C. E. (Advanced Level) Mathematics syllabus was conducted in 1998. One of the main reasons for the need to revise the earlier syllabus had been that in the Learning-Teaching-Assessment process, competencies and competency levels had not been introduced adequately. It has been planned to change the existing syllabus that had been designed on a content based approach to a competency based curriculum in 2009. In 2007, the new curriculum revision which started at Grades 6 and 10 had introduced a competency based syllabi to Mathematics. This was continued at Grades 7 and 11 in 2008 and it will be continued to Grades 8 and 12 in 2009. Thus, a need has arisen to provide a competency based syllabus for mathematics at G. C. E. (Advanced Level) to those pupils who had followed a competency based syllabus at Grades 10 and 11.

The arrival of the computer on the national scene and the increasing use of mathematical techniques in the Biological Science and Social Sciences have brought about a new situation requiring the teaching of such techniques at the G.C.E. (Advanced Level).

In order to cater the above situation a third subject called "Mathematics" was introduced in 1998 for the first time.

Now this subject "Mathematics" is revised and rearranged in a way so that Mathematics I contains Pure Mathematics Components and Mathematics II contains Probability and Statistics Components.

The subject may not be offered by students taking Combined Mathematics or Higher Mathematics at the G. C. E. (Advanced Level).

2.0 AIMS OF THE SYLLABUS

i. To provide basic skills of mathematics to continue higher studies of mathematics.

ii. To provide the students experience on strategies of solving mathematical problems.

iii. To improve the students knowledge of logical thinking on mathematics.

iv. To motivate the students to learn mathematics

This syllabus was prepared to achieve the above objectives through learning mathematics. It is expected not only to improve the knowledge of mathematics but also to improve the skills of applying the knowledge of mathematics in their day to day life and character development through this new syllabus.

When we implement this competency Based Syllabus in the learning - teaching process.

- Meaningful Discovery situations provided would lead to learning that would be more student centered.
- It will provide competencies according to the level of the students.
- Teacher's targets will be more specific.
- Teacher can provide necessary feed back as he/she is able to identify the student's levels of achieving each competency level.
- Teacher can play a transformation role by being away from other traditional teaching methods.

When this syllabus is implemented in the classroom the teacher should be able to create new teaching techniques by relating to various situations under given topics according to the current needs.

For the teachers it would be easy to assess and evaluate the achievement levels of students as it will facilitate to do activities on each competency level in the learning - teaching process.

In this syllabus, the sections given below are helpful in the teaching - learning process of Mathematics.

Proposed Term Wise Breakdown of the Syllabus

Grade 12

Competency Level	Content	Number of Periods
Term 1		
Mathematics I		
1.1, 1.2, 1.3	Real Number System	12
3.3, 3.4	Polynomials	07
11.1	Cartesian Coordinates	06
10.1	Trigonometric Ratios	08
2.1, 2.2, 2.3, 2.4	Set Algebra	20
2.5, 2.6	Relations	16
Mathematics II		
1.1, 1.2	Basics of Statistics	10
2.1, 2.2, 2.3, 2.4	Presenting Data and Information	42
Term 2		
Mathematics I		
3.1, 3.2	One Variable Functions	14
4.1	Simple Algebraic Inequalities	10
3.5, 3.6	Quadratic Functions and Equations	30
Mathematics II		
3.1, 3.2, 3.3, 3.4, 3.5	Measures of Central Tendency and Dispersion	46
Term 3		
Mathematics I		
3.7	Rational Functions	05
3.8	Exponential Functions	06
13.1, 13.2, 13.3, 13.4, 13.5	Derivatives I	19
10.2, 10.3, 10.4, 10.5	Trigonometry	25
11.2, 11.3, 11.4, 11.5, 11.6, 11.7	Straight Line	23
Mathematics II		
3.6, 3.7	Skewness	18
4.0	Index Numbers	15

Grade 13

Competency Level	Content	Number of Periods
Term 1		
Mathematics I		
5.1, 5.2	Permutation and Combinations	27
13.6, 13.7	Derivatives II	10
13.8, 13.9, 13.10, 13.11	Integration	15
Mathematics II		
5.1, 5.2, 5.3, 5.4, 5.5	Probability	50
Term 2		
Mathematics I		
6	Binomial Expansion	12
7.1, 7.2, 7.3, 7.4	Series	23
13.12, 13.13, 13.14	Integration	10
4.2	Inequalities involving moduli	10
Mathematics II		
5.6, 5.7, 5.8, 5.9	Probability Distribution (Discrete)	30
6.1, 6.2	Linear Programming	18
Term 3		
Mathematics I		
9.1, 9.2, 9.3	Matrices	17
8.1, 8.2	Determinants	16
12.1, 12.2, 12.3, 12.4	Circles	10
Mathematics II		
5.10	Probability Distribution (Discrete)	20
5.11	Probability Distribution (Continous and approximation)	20
7.0	Networks	24

Competency	Competency level	Content	No. of Periods
1. Analysis the Real Number system.			
	1.1 Classifies the Real number system.	● Historical evolution of the number system ● Set notation for numbers ● Geometrical representation of a real number.	02
	1.2 Uses surds or decimals to communicate numbers.	● Decimal representation of a real number. • Finite decimals • Recurring decimals • Infinite decimals	04
	1.3 Uses Exponents and Radicals to communicate numbers	● Positive integral Exponents ● Negative and Zero Exponents ● Fractional Exponents ● Rationalizing Denominantors	06
2. Manipulates Set Algebra			
	2.1 Applies basic mathematics operations of sets to solve problems.	● Set language and elements of a set • Universal set, Null set, Finite set and Infinite set, Cardinality of a set • Equivalent sets, Equal sets, Sub sets, Proper sub sets and Power sets.	03
	2.2 Uses set algebra to solve problems.	● Set operations • Intersection, Union and Difference • Complement, Relative complement • The formula $n(A \cup B) = n(A) + n(B) - n(A \cap B)$	05

Competency	Competency level	Content	No. of Periods
	2.3 States logical relations in terms of set operations	● Truth sets on propositions • Definition of a truth set τ (P) on a proposition P • Relationships between set operations and logical relations $\tau(P \cap Q) = \tau(P) \cap \tau(Q)$ $\tau(P \cup Q) = \tau(P) \cup \tau(Q)$ $\tau(\approx P) = \tau(P)'$ $P \rightarrow Q \leftrightarrow \tau(P) \subset \tau(Q)$	10
	2.4 States the Cartesian products on sets	● Ordered pairs ● Product sets • Product of two sets A x B ● Extension of Product sets • Cartesian extension to three or more sets	02
	2.5 Expresses a relation in terms of ordered pairs.	● Definition of relations and examples. ● Relations in the form of ordered pairs. • Relation as a subset of a product set Examples • Domain and Range of the relation ● Into relations and onto relations ● Inverse relations • Definition, examples	10
	2.6 Analyses Relations	● Equivalence Relations • Reflexive, Symmetric and Transitive properties, Partition of a set, examples, Equivalance classes	06

Competency	Competency level	Content	No. of Periods
3. Analyses one variable functions	3.1 Investigates functions	● Concept of a function as one-one or many-one relation ● Definition of a function • Realisation of domain and range, one-one and onto functions, examples ● Graph of functions, vertical line test for function ● Elementry functions $(f(x) = ax + b$, $f(x) = \|x\|$, $f(x) = x^2$, $f(x) = \frac{1}{x}, x \neq 0)$	07
	3.2 Investigates relations between functions	● Composite functions • Composition of two functions, examples ● Inverse functions • Identity function • Definition of inverse function examples	07
	3.3 Investigates one variable polynomials	● One variable polynomial functions • Degree, leading term and leading coefficient • Properties of identically equal polynomials	02

Competency	Competency level	Content	No. of Periods
	3.4 Uses mathematical operations involving polynomials	● Mathematical operations involving polynomials • Addition, subtraction • Multiplication • Division, long division • Synthetic division by a linear expression • Remainder theorem • Factor theorem	05
	3.5 Investigates the properties of a quadratic function	● Quadratic functions • Completion of square of a quadratic function • Discriminant • Least and greatest value • Drawing the graph ● Examples involving the application of the properties of a quadratic function	15
	3.6 Investigates the quadratic equation which gives the zero value of the quadratic function	● Quadratic equation • Solution by completion of square • Graphical solution ● Use of quadratic formula • Discriminant Δ ● Analysis of roots • Real and distinct • Real and coincident • Not real ● Simultaneous equations in two variables, One linear and one quadratic	15

Competency	Competency level	Content	No. of Periods
	3.7 Resolution of a rational function into partial fractions	● Rational functions • Proper rational functions • Improper rational functions ● Partial fractions • Partial fractions of proper rational functions - with distinct factors in the denominator - with recurring factors in the denominator ● Partial fractions of improper rational functions	05
	3.8 Analyses the Exponential and Logarithmic functions	● Exponential function and its properties • Graphs on growth and decline of population • Definition of e • Properties of e^x • Graph of e^x ● Logarithmic function and its properties • Properties of ln x • Change of base • Graph of ln x ● Examples on compound Interest, pH value, Radioactive emmision, Population growth etc.	06
4. Manupulates simple algebraic inequalities	4.1 Solves problems involving linear and quadratic inequalitics	● Simple Algebraic inequalities • Manipulation of linear, quadratic inequalities $f(x) \lesseqgtr 0$, where $f(x)$ is a polynomial (degree $\leqslant 3$) $\frac{f(x)}{g(x)} \geqslant 0$, where $f(x)$, $g(x)$ are polynomialof x (degree ≤ 3)	10

Competency	Competency level	Content	No. of Periods
	4.2 Solves problems involving moduli	● Use of modulus sign • Review of the modulus function • Solution of simple inequalities involving the modulus sign. $\|ax+b\| \leqq \|cx+d\|$ $\|ax+b\| \leqq cx+d$ $\|x+a\| + \|x+b\| \geq \|x+c\|$	10
5. Uses permutations and combinations as mathematical models for selections and arrangements.	5.1 Uses permutations as a technique of solving Mathematical problems	● Fundamental principle of counting • Clarification by examples ● Factorial notation • permutation for distinct objects taken *r* at a time from *n* objects ${}^{n}P_{r}$ notation. ● Permutations of *n* things not all different . ● Cyclic Permutation.	07
	5.2 Uses combinations as a technique of solving Mathematical problems	● Introduction of the concept of combination with 3 or 4 distinct objects. ● Number of combinations of *n* distinct objects taken *r* at a time. ${}^{n}C_{r}$ notation and formula, problems with particular values for *n* and *r* are considered.	20

Competency	Competency level	Content	No. of Periods
6. Uses the Binomial Theorem for positive integral index		The symbol ${}^nC_r$, ${}^nC_r = \frac{n!}{r!(n-r)!}$ Prperties of ${}^nC_r$ ${}^nC_0 = {}^nC_n = 1$; ${}^nC_1 = n$ ${}^nC_r = {}^nC_{n-r}$ ${}^{n+1}C_r = {}^nC_{r-1} + {}^nC_r$ ● Ordered sampling • Without replacement • With replacement ● Expansion of $(1+x)^3$, $(1+x)^4$ expressing the coefficients in the form ${}^nC_r$ ● Application of $(1+x)^n = \sum_{r=0}^{n} {}^nC_r\, x^r$ ● Expansion of $(a+x)^n = \sum_{r=0}^{n} {}^nC_r\, a^{n-r}(x)^r$ ● Application of Binomial theorem	12
7. Finds the sum of a simple series	7.1 Solves problems involving arithmetic and geometric series	● Sequences ● Series • Summation, general term	05

Competency	Competency level	Content	No. of Periods
	7.2 Sums series whose general term is a polynomial or a rational function	$\sum_{r=1}^{n} U_r$ $\sum_{r=1}^{n} (kU_r) = k\sum_{r=1}^{n} U_r$ $\sum_{r=1}^{n} (U_r + V_r) = \sum_{r=1}^{n} U_r + \sum_{r=1}^{n} V_r$ ● Arithmetic series • Arithmetic progression, general term, Sum to *n* terms, applications. ● Geometric Series • Geometric progression, general term, Sum to *n* terms, applications. ● Summation of series • Summation of the series of the form $\sum_{r=1}^{n} r,\ \sum_{r=1}^{n} r^2,\ \sum_{r=1}^{n} r^3,\ \sum_{r=1}^{n} r(r+1)$ $\sum_{r=1}^{n} \frac{1}{r(r+1)}$ ● Summation of series using, • Method of differences • Method of partial fractions	08

Competency	Competency level	Content	No. of Periods
	7.3 Uses the Principle of Mathematical induction for the summation of series	• Using known series • Use of the principle of Mathematical induction in proving results such as $\sum_{r=1}^{n} r^2 \equiv \frac{1}{6}n(n+1)(2n+1)$	05

	7.4 Interprets the sum of an infinite seies	• Idea of a limit
		  ◦ Intuitive idea about a limit for the purpose of introduction only
		e.g., the limit of $\frac{1}{n}, \frac{n}{n+1}, \frac{1}{2^n}$ as $n \to \infty$
		  ◦ Limit of a sequence
		  ◦ Sum of an infinite series
		• Fundamental Difference Equations
		  ◦ Introduction, examples such as growth, emission, compound interest, decay
		  ◦ Solutions to linear difference equations of the first degree. (Homogenous and non-homogenous) illustration
		• Convergence of geometric series
		  ◦ Limit of r^n as $n \to \infty$
		  ◦ Convergence of geometric series, Sum to infinity, examples
			05

06

Competency	Competency level	Content	No. of Periods
8. Manipulates Determinants as a mathematical model of solving problems.	8.1 Interprets the properties of determinants of order two and three	● Introduction : By solution of two simultaneous equations with two unknowns. ● Properties • Interchange of two rows or two columns changes the sign of the determinant. • If two rows or two columns of a determinant are identical the determinant becomes zero. • If k is a common factor of all the elements in a row or a column, then k is a common factor of the determinant	06
	8.2 Solves equations with two or three unknowns using determinants	● Use of a second order determinant in solving simultaneous equations with two unknowns. ● General solutions of linear simultaneous equations with three unknowns. Determinant form; Cramer's rule.	10
9. Manipulates Matrices as an algebraic system	9.1 Describes Matrix Algebra	● Definition and clarification on the use of matrix notation. ● Matrix addition • Compatibility for addition • Commutative and Associative Laws for addition ● Scalar multiplication • Distributive Law for addition over scalar multiplication ● Matrix multiplication • Compatibility of matrices for multiplication • Illustrating that matrix multiplication is not commutative	05

Competency	Competency level	Content	No. of Periods
	9.2 Investigates the properties of square matrices.	● Square Matrices • Unit matrix • Diagonal matrix ● Algebra of square matrices • Associativity of matrix multiplication (AB) C = A (BC) • Distributivity of matrix multiplication over addition A (B + C) = AB + AC (B + C) A = BA + CA • IA = A = AI, where I is the unit matrix of order same as A • When f(x) is a polynomial in *x* computation of f(A) ● Transpose • $(A + B)^T = A^T + B^T$ • $(A^T)^T = A$ • $(kA)^T = kA^T$, where k is a real number • $(AB)^T = B^T A^T$	07
	9.3 Determines the inverse of a 2 x 2 matrix	● Inverse of a 2 x 2 matrix • Inverse of $\begin{pmatrix} a_1 & b_1 \\ a_2 & b_2 \end{pmatrix}$ $= \frac{1}{a_1 b_2 - a_2 b_1} \begin{pmatrix} b_2 & -b_1 \\ -a_2 & a_1 \end{pmatrix}$ • $(AB)^{-1} = B^{-1}A^{-1}$ and $(A^{-1})^T = (A^T)^{-1}$	05

Competency	Competency level	Content	No. of Periods
10. Interprets trigonometric ratios	10.1 Describes trigonometric ratios	● Definition of the six trigonometric ratios • Degree and Radian measure of an angle, definition of the functions sine, cosine, tangent, cosecant, secant, and the cotangent of a general angle. • The sign of the trigonometric functions in each quadrant. • The six values of the trigonometric functions for $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$.... etc.	08
	10.2 Investigates trigonometric functions geometrically	● Graphs of trigonometric functions • Symmetry and periodicity of the six trigonometric functions • Horizontal and vertical translations e.g. $y = \sin x + k$ $y = \sin(x + \alpha)$ • Graph of $y = a \sin bx$	06
	10.3 States the basic trigonometric identities	● Deriving the basic trigonometric identities using the Pythagoras' theorem. • $\sin^2\theta + \cos^2\theta = 1$ • $1 + \tan^2\theta = \sec^2\theta$ • $\cot^2\theta + 1 = \cos ec^2\theta$ • Use of above results to solve problems ● Simplification of trigonometric expressions	06

Competency	Competency level	Content	No. of Periods
	10.4 Uses addition formulae	● Addition formulae • Formulae for $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$ • Formulae for $(\sin A \pm \sin B)$ and $(\cos A \pm \cos B)$ • Formulae for double angles, triple angles and half angles • Solutions of simple trigonometric equations	05
	10.5 Uses the sine formulae and cos formulae for a triangle	● sine formula and cosine formula ● Trigonometric applications for simple 2 or 3 dimensional problems	08
11. Investigates a straight line in terms of cartesian co-ordinates			
	11.1 Finds the distance between two points and the area of a triangle in terms of cartesian co-ordinates	● Rectangular Cartesian co-ordinates • Co-ordinate axes, origin of co-ordinates, quadrants, abcissa, ordinate • Distance between two points • Co-ordinates of the point dividing the straight line segment joining two points in a given ratio • Area of a triangle with given vertices	06
	11.2 Describes the equation of a straight line	● Straight line • Inclination and gradient of a straight line (for straight lines not parallel to the *y*-axis) • X - intercept, Y - intercept of a straight line	02

Competency	Competency level	Content	No. of Periods
	11.3 Interprets the equation of a straight line	● Diverse forms of the equation of a straight line • Point - gradient form $y-y_1=m(x-x_1)$ • Gradient - intercept form $y=mx+c$ • Double point form $y-y_1=\frac{y_2-y_1}{x_2-x_1}(x-x_1)$ • Intercept form $\frac{x}{a}+\frac{y}{b}=1$ • General form $ax+by+c=0$ • Interpretation of the general form when (i) $a=0$, (ii) $b=0$, (iii) $c=0$	05
	11.4 Derives the equation of a straight line passing through the point of intersection of two given straight lines.	● Point of intersection of two straight lines ● Interpretation of the equation $v+\lambda V=0$, where $v=0$ and $V=0$ are the equations of two intersecting straight lines	02
	11.5 Position of two points relative to a given straight line	● The condition that two given points are on the same or opposite sides of a given straight line	02
	11.6 Finds the angle between two straight lines	● Angle between two lines • parallel, perpendicular	02
	11.7 Derives results related to a straight line in terms of the distance of the perpendicular drawn to it from a given point	● Parametric Equation of a straight line ● Perpendicular distance from a point to a straight line ● Image of a point with respect to a straight line ● Equations of the bisectors of the angles between two intersective straight lines	10

Competency	Competency level	Content	No. of Periods
12. Interprets the cartesian equation of a circle			
	12.1 Finds the cartesian equation of a circle	● Equation of a circle with centre as the origin and given radius ● Equation of a circle with given centre and radius ● General equation of a circle, its radius and centre	02
	12.2 Describes the position of a point relative to a circle	● Position of a point relative to a circle	01
	12.3 Describes the position of a straight line relative to a circle	● Condition for a circle and a straight line intersects, touches or do not intersect ● Equation of the tangent to a circle at a point on it	03
	12.4 Interprets the tangents drawn to a circle from an external point and the chord of contact	● The length of the tangent drawn from an external point to a circle and its equation ● Equation of chord of contanct	04
13. Uses the derivatives of a function to solve problems			
	13.1 Investigates the continuity of a function in terms of its limit	● Continuity of a function in some interval • Left hand limit of a function at a point • Right hand limit of a function at a point • Existence of a limit of a function at a point • Continuity of a function at an interval	02
			04

Competency	Competency level	Content	No. of Periods

	13.2 Interprets the derivative of a function or the differential coefficient	• Definition of the derivative of $f(x)$ at a point x_0 as $\lim_{\delta x \to 0} \frac{f(x_0+\delta x)-f(x_0)}{\delta x}$
		• That the limiting position of the line joining two points on a curve is the tangent to the curve
		  • Slope of the tangential line
		  • That the rate of change is given by the derivatives
			04

	13.3 Finds the derivatives of simple algebraic exponential logarithmic and geometric functions	• Derivatives of the functions $x^n, e^x, \sin x, \cos x, \tan x$ and $ln\lvert x\rvert$	05

	13.4 Uses the formulae for the derivative of the sum, product and the quotient of two functions	• Rules for finding the derivatives of the sum, product and quotient of two functions and their applications (without proof)
		  • $\frac{d}{dx}(u \pm v) = \frac{du}{dx} \pm \frac{dv}{dx}$
		  • $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$
		  • $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
			04

	13.5 Uses the chain Rule to find the derivative	• $\frac{dy}{dx} = \frac{dy}{dz} \cdot \frac{dz}{dx}$	04

Competency	Competency level	Content	No. of Periods
	13.6 Determines the behaviour of a function using derivatives	● Increasing functions, Decreasing functions, stationary points of functions (Maximum, Minimum, point of inflexion) ● Solution of practical problems using derivatives	06
	13.7 Sketching simple curves using derivatives	● Drawing simple curves using derivatives (horizontal and vertical asymptotes)	04
	13.8 Identifies Intergtation as the inverse of differentiation	● Antiderivative or Integral and indefinite integral Use of basic theorems such as • $\int (f(x) \pm g(x))dx = \int f(x)dx + \int g(x)dx$ • $\int \lambda f(x)dx = \lambda \int f(x)dx$	02
	13.9 Identifies integration results of standard functions	● Integrals of standard functions ● For the functions • $x^n, e^x, \sin x, \cos x, \tan x, \sec^2 x$ • $\int \frac{f'(x)}{f(x)}dx = ln\lvert f(x) \rvert + c$	05
	13.10 Determines definite integrals using the basic theorem in integration	● Definite integrals • $\int_a^b f(x)\,dx$ • Model problems leading to integrals of the standard forms $\int_a^b \frac{dx}{x}$, $\int_a^b \frac{dx}{(M-x)}$ and $\int_a^b \frac{dx}{x(M-x)}$	06

Competency	Competency level	Content	No. of Periods
	13.11 Uses diverse methods for integration	• Methods of simple substitutions • $\int f(x)\,[f(x)]^r dx = \frac{1}{r+1}[f(x)]^{r+1} + C$ $r \neq -1$ $= ln\lvert f(x)\rvert + C\,;\, r = -1$ • Integration of simple rational functions using partial fractions	02
	13.12 Solves integration problems using the method of integration by parts	• $\int udv = uv - \int vdu$	04
	13.13 Determines the area of a region bounded by curves using integration	• Uses of integrations • Area under a curve • Area between two curves	04
	13.14 Uses method of approximation to solve problems	• Numerical integratoin using trapezium rule and Simpson's rule	02

Competency	Competency level	Content	No. of Periods
1. Interprets the basics of statistics			
	1.1 Investigates the nature of statistics	● What is statistics? ● Nature of statistics • Descriptive statistics • Inferential statistics • Probability and Distribution Theory • Connection between discriptive, inferential and probability theory • Application of Statistics	04
	1.2 Manupulates data to obtain information	● Data and Information ● Experiments and Data ● Controlled Experiments and surveys ● Types of Data • Discrete data • Continuous data ● Information ● Distinction between data and information	06
2. Presents data and information elementarily			
	2.1 Classifies data and information	● Techniques of presenting data ● Classification of data • Classification of data as a process of arranging objects • Aims of classification • Basis of classification	06

Competency	Competency level	Content	No. of Periods
	2.2 Tabulates data and facts	● Techniques of tabulation • Construction of a statistical table • Ungrouped frequency distribution • Grouped frequency distribution • Construction of two way tables • Importance of statistical tabulation	08
	2.3 Denotes data and information figuratively	● Figurative techniques • Importance of figurative techniques • Limits and rules • Geometrical forms • Bar charts • Techniques of constructing bar charts • Types of bar charts • Pie charts • Maps and graphs	16
	2.4 Denotes data and information graphically	● Graphical techniqes (lines and curve forms) • Line graphs • Line graphs for more than one variable • Depicting frequency series • Histogram • Frequency Polygon • Smooth frequency curves • Ogives or cumulative frequency curves • Cumulative percentile curves	12

Competency	Competency level	Content	No. of Periods
3. Interprets the behaviour of a frequency distribution	3.1 Analyses mean as a measure of central tendency	● Mean for classified & unclassified data ● Mean • weighted mean • geometric mean • harmonic mean	12
	3.2 Interprets the frequency distribution in terms of values of relative positions	● Measures of relative positions of a frequency distribution. • Median • quartiles • deciles • percentiles	06
	3.3 Analyses mode as a measure of central tendency	● Mode of a frequency distribution	04
	3.4 Uses suitable measures of central tendency to reach decisions on frequency distributions.	● Relative importance of measures of central tendency	06
	3.5 Interprets the dispersion of a distribution using measures of deviation	● Measures of dispersion ● Importance of measures of dispersion ● Types of dispersion • Range • Semi interquartile range • Mean deviation • Variance • Standard deviation • Coeficient of variation as a relative measure of dispersion	18

Competency	Competency level	Content	No. of Periods
	3.6 Decides on the shape of a distribution using measures of skewness	● Measures of skewness • Karl Pearson's measure of skewness • Bowley's quartile measure of skewness • Cayley's percentile measure of skewness	10
	3.7 Decides on the shape of a distribution using Moments and Kurtosis	● Moments and Kurtosis • Moments • Kurtosis	08
4. Predicts the variation of a quantity using index numbers		● Meaning and use of an index number ● Problems encountered in the construction of an index number ● Methods of constructing index numbers • Unweighted index numbers; price index • Quantity or volume index numbers • Value index numbers • Weighted index numbers • Cost of living index	15
5. Analyses random phenomena mathematically	5.1 Determines the events of a random experiment	● Experiments and events • Types of experiments • Deterministic experiments • Non-deterministic or random experiments • Possible outcomes of an experiment • Tree diagrams • Sample space of an experiment	09

Competency	Competency level	Content	No. of Periods

		• Events
		  • Event
		  • Event space
		  • Types of events	

	5.2 Interprets probability	● Classical definition of probability ● Statistical definition of probability ● Axiomatic definition of probability ● Laws of probability	14

	5.3 Decides the possibility of an event in terms of conditional Probability	● Conditional probability
		  • Definition
		  • Conditional Probability outcomes
		  • Chain rule
		  • Chain rule for two events
		  • Extension of the chain rule for more than two events
			12

	5.4 Uses Baye's Theorem as a derivative of the Total Probability Theorem	● Partition of the sample space ● Total probability ● Baye's Theorem	10
	5.5 Interprets the independence of two random events	● Independent events ● Independence of several events	05
	5.6 Interprets random variables	● Possible values of a random variable ● Discrete and continuous random variables	05

Competency	Competency level	Content	No. of Periods
	5.7 Analyses the properties of a probability distribution of a continuous and a discrete random variable	● Probability distribution of a discrete random variable ● Probability density function of a continuous random variable	10
	5.8 Interprets the mathematical expectation of a random variable	● Mathematical expectation • Mean • Variance • Moments	10
	5.9 Determines the cumulative distribution function of a random variable	● Cumulative distribution function of a random variable	05
	5.10 Constructs models for special discrete probability distributions, calculates probability and interpret	● Discrete probability distributions • Bernoulli • Discrete uniform • Binomial • Poisson	20
	5.11 Calculates probability using theoritical models and interprets the density functions of special continuous distribution	● Continuous distributions • Uniform • Exponential • Normal and standard normal distributions	20

Competency	Competency level	Content	No. of Periods
6. Determines the optimum solution of a linear programming problem	6.1 Constructs a Linear Programming model	● Linear Programming • Types of problems • No answer problems • Single answer problems • Multiple answer problems ● Construction of a linear programming model • Decision variable • Objective function • Notation in standard form • Constraints • Non-negative conditions • Feasible region	12
	6.2 Determines the solution of a linear programming problem graphically	● Linear programming graphical solution • Solution of a maximising model • Solution of a minimising model	06
7. Analyses plans using networks		● Networks and their applications ● Networks and definition of terms ● Applications • Critical path • Minimum spanning problems • High flow problems • Planning of projects and critical path analysis	24

4.0 TEACHING LEARNING STRATEGIES

To facilitate the students to achieve the anticipated outcome of this course, a variety of teaching strategies must be employed. If students are to improve their mathematical communication, for example, they must have the opportunity to discuss interpretations, solutions, explanations etc. with other students as well as their teacher. They should be encouraged to communicate not only in writing but orally, and to use diagrams as well as numerical, symbolic and word statements in their explanations.

Students learn in a multitude of ways. Students can be mainly visual, auditory or kinesthetic learners, or employ a variety of senses when learning. The range of learning styles is influenced by many factors, each of which needs to be considered in determining the most appropriate teaching strategies. Research suggests that the cultural and social background has a significant impact on the way students learn mathematics. These differences need to be recognised and a variety of teaching strategies to be employed so that all students have equal access to the development of mathematical knowledge and skills.

Learning can occur within a large group where the class is taught as a whole and also within a small group where students interact with other members of the group, or at an individual level where a student interacts with the teacher or another student, or works independently. All arrangements have their place in the mathematics classroom.

5.0 SCHOOL POLICY AND PROGRAMMES

To make learning of Mathematics meaningful and relevant to the students classroom work ought not to be based purely on the development of knowledge and skills but also should encompass areas like communication, connections, reasoning and problem solving. The latter four aims, ensure the enhancement of the thinking and behavioural process of children.

For this purpose apart from normal classroom teaching the following co-curricular activities will provide the opportunity for participation of every child in the learning process.

Student's study circles
Mathematical Societies
Mathematical camps
Contests (national and international)
Use of the library
The classroom wall bulletin
Mathematical laboratory
Activity room
Collecting historical data regarding mathematics
Use of multimedia
Projects

It is the responsibility of the mathematics teacher to organise the above activities according to the facilities available. When organising these activities the teacher and the students can obtain the assistance of relevant outside persons and institutions.

In order to organise such activities on a regular basis it is essential that each school develops a policy of its own in respect of Mathematics. This would form a part of the overall school policy to be developed by each school. In developing the policy, in respect of Mathematics, the school should take cognisance of the physical environment of the school and neighbourhood, the needs and concerns of the students and the community associated with the school and the services of resource personnel and institutions to which the school has access.

The school should develop its annual programmes, consisting of a variety of activities for achieving policy goals. In determining the activities to be undertaken during a particular year, the school will need to identify priorities and consider feasibility in relation to time and resource constraints. However, the school could organise a range of activities adequate to cater to the development of the variety of interests and aptitudes of different students.

6.0 ASSESSMENT AND EVALUATION

It is intended to implement this syllabus in schools with the School Based Assessment (SBA) process. Teachers will prepare creative teaching - learning instruments on the basic of school terms.

The First Examination under this syllabus will be held in 2011.

The details together with the format and the nature of questions will be introduced by the Department of Examination.

NOTATION

The following Mathematical notation will be used.

1. *Set Notation*

$\in$	is an element of
$\notin$	is not an element of
$\{x_1, x_2, \ldots\}$	the set with elements x_1, x_2, ...
$\{x: \ldots\}$	the set of all x such that . . .
$n(A)$	the number of elements in set A
ϕ	the empty set
ε	the universal set
A^{-1}	the complement of the set A
$\mathbb{N}$	the set of positive integers and zero, $\{0, 1, 2, ...\}$
$\mathbb{Z}$	the set of integers
$\mathbb{Z}^+$	the set of positive integers $\{1, 2, 3, \ldots\}$
$\mathbb{Z}_n$	the set of integers modulo n, $\{0, 1, 2, \ldots, n-1\}$
$\mathbb{Q}$	the set of rational numbers
$\mathbb{Q}^+$	the set of positive rational numbers $\{x \in \mathbb{Q}: x > 0\}$
$\mathbb{Q}_0^+$	the set of positive rational numbers and zero $\{x \in \mathbb{Q}: x \geq 0\}$
$\mathbb{R}$	the set of real numbers
$\mathbb{R}^+$	the set of positive real numbers $\{x \in \mathbb{R}: x > 0\}$
$\mathbb{R}_0^+$	the set of positive real numbers and zero $\{x \in \mathbb{R}: x \geq 0\}$
$\mathbb{R}^n$	the real n tuples
$\mathbb{C}$	the set of complex numbers
$\subseteq$	is a subset of
$\subset$	is a proper subset of
$\not\subseteq$	is not a subset of
$\not\subset$	is not a proper subset of
$\cup$	union
$\{0, \pm1, \pm2, \ldots\}$ $\cap$	intersection
$[a,b]$	the closed interval $\{x \in \mathbb{R}: a \leq x \leq b\}$
$(a,b]$	the interval $\{x \in \mathbb{R}: a < x \leq b\}$
$[a, b)$	the interval $\{x \in \mathbb{R}: a \leq x < b\}$
(a, b)	the open interval $\{x \in \mathbb{R}: a < x < b\}$
$y\mathbb{R}x$	y is related to x by the relation R
$y \sim x$	y is equivalent to x, in the context of some equivalence relation

2. *Miscellaneous Symbols*

$=$	is equal to
$\neq$	is not equal to
$\equiv$	is identical to or congruent to
$\approx$	is approximately equal to
$\cong$	is isomorphic to
$\propto$	is proportional to
$<$	is less than
$\leq,\ \not>$	is less than or equal to or is not greater than
$>$	is greater than
$\geq,\ \not<$	is greater than or equal to or is not less than
∞	infinity
$\sim p$	not p
$p => q$	p implies q (if p then q)
p < = > q	p implies and is implied by q (p is equivalent to q)
$p \vee q$	p or q
$p \wedge q$	p and q
	open interval on the number line
	closed interval on the number line

3. *Operations*

$a + b$	a plus b
$a - b$	a minus b
$a \times b,\ ab,\ a.b$	a multipllied by b
$a \div b,\ \frac{a}{b},\ a/b$	a divided by b
$a : b$	the ratio of a to b
$\sum_{r=1}^{n} a_r$	$a_1 + a_2 + \ldots + a_n$
$\sqrt{a}$	the positive square root of the real number a
$\lvert a \rvert$	the modulus of the real number a
$n!$	n factorial for $n \in \mathbb{N}\,(0! = 1)$
$\binom{n}{r}$	the binomial coefficient
	$\frac{n!}{r!(n-r)!}$ for $n,\ r \in \mathbb{N},\ 0 \leq r \leq n$
	$\frac{n(n-1)\ldots(n-r+1)}{r!}$ for $n \in \mathbb{Q},\ r \in \mathbb{N}$
${}^{n}p_r$	Permutation of n things taken r at a time
${}^{n}C_r$	Combination of n things taken r at a time

4. *Functions*

f	function f
$f(x)$	the value of the function f at x
$f: A \to B$	f is a function under which each element of set A has an Image in set B
$f: x \to y$	the function f maps the element x to the element y
f^{-1}	the inverse of the function f
$g\ o\ f$	the composite function of f and g which is defined by $g\ o\ f\ (x)$
$\lim_{x \to a} f(x)$	the limit of f(x) as x tends to a
δx	an increment of x
$\frac{dy}{dx}$	the derivative of y with respect to x
$\frac{d^n y}{dx^n}$	the n[th] derivative of f (y) with respect to x
$f^1(x), f^{11}(x), \ldots, f^{(n)}(x)$	the first, second, ..., n[th] derivatives of f (x) with respect to x
$\int y dx$	indefinite integral of y with respect to x
$\int_a^b y dx$	the definite integral of y with respect to x for values of x between a and b
$\dot{x}, \ddot{x}, \ldots$	the first, second, ... derivative of x with re spect to time

5. *Exponential and Logarithmic Functions*

e	base of natural logarithms
$e^x, \exp x$	exponential function of x
$\log_a x$	logarithm to the base a of x
$l\,n\ x$	natural logarithm of x
$lg\ x$	logarithm of x to base 10

6. *Circular Functions*

$\left.\begin{matrix}\sin, \cos, \tan \\ \text{cosec}, \sec, \cot\end{matrix}\right\}$ the circular functions

$\left.\begin{matrix}\sin^{-1}, \cos^{-1}, \tan^{-1} \\ \text{cosec}^{-1}, \sec^{-1}, \cot^{-1}\end{matrix}\right\}$ the inverse circular functions

7. *Complex Numbers*

i	the square root of -1
Z	a complex number, $Z = x + iy$
	$= r(\cos\theta + i\sin\theta), r \in \mathbb{R}_0^-$
	$= re^{i\theta}, r \in \mathbb{R}_0^-$
Re Z	the real part of Z, re $(x + iy) = x$
Im Z	the imaginary part of Z, Im $(x+iy) = y$
$\lvert Z \rvert$	the modulus of Z
arg Z	The argument of Z
Arg Z	the principle argument of Z
Z^{-1}	the complex conjugate of Z

8. *Matrices*

M	a matrix M
M^{-1}	the inverse of the square matrix M
M^T	the transpose of the matrix M
det M	the determinant of the square matrix M

9. *Vectors*

$\boldsymbol{a}$	the vector
$\overline{AB}$	the vactor represented in magnitude and direction by the directed line segment AB
$\hat{\underline{a}}$	a unit vector in the direction of the vector a
$\underline{i}, \underline{j}, \underline{k}$	unit vectors in the direction of the cartesian coordinate axes
$\lvert\underline{a}\rvert$	the magnitude of a
$\lvert\overline{AB}\rvert$	the magnitude of AB
$a \cdot b$	the scalar product of a and b
$a \times b$	the vetor product of a and b
$[a, b, c]$	the scalar triple product of a, b and c

$[a,b,c] = a \times b \cdot c$

10. *Probability and Statistics*

A , B, C, ect.	events
$A \cup B$	union of the events A and B
$A \cap B$	intersection of the events A and B
P(A)	probability of the event A
A'	complement of the event A, the event 'not A'
$P(A \mid B)$	probability of the event A given the event B
X, Y, R, etc.	random variables
x, y, r, etc.	values of the random variables X, Y, R, etc.
$x_1, x_2, \ldots$	observations
$f_1, f_2, \ldots$	frequencies with which the observations $x_1, x_2 \ldots$ occur
P(x)	the value of the probability function
p(X = x)	of the discrete random variable x
$P_1, P_2, \ldots$	probabilities of the values, $x_1, x_2 \ldots$ of the discrete random variable X
$f(x), G(x), \ldots$	the value of probability density function of the continuous random variable x
F(x), g(x), . . .	the value of the (cumulative) distribution function $P(X \leq x)$ of the random variable X
E(X)	expectation of the random variable X
E[g(X)]	expectation of g(X)
Var (X)	variance of the random variable X
G (t)	the value of the probability generating function for a random variable which takes integer values

B (n . p)	binomial distribution, parameters n and p
$N(\mu, \sigma^2)$	normal distribution, mean μ and variance σ^2
μ	population mean
σ^2	population variance
σ	population standard deviation
$\bar{x}$	sample mean
s^2	unbiased estimate of population variance from a sample, $s^2 = \frac{1}{n-r}\sum (x-\bar{x})^2$
ϕ	probability density function of the standardised normal variable with distribution N(0,1)