GENERAL CERTIFICATE OF EDUCATION
ADVANCED LEVEL
(Grade 12 and 13)

MATHEMATICS
SYLLABUS
(Effective from 2017)

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Faculty of Science and Technology
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Maharagama
SRI LANKA

Mathematics

Grade 12 and 13 - syllabus

Contents

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) Combined Mathematics syllabus was conducted in 1998. One of the main reason 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 continued to Grades 8 and 12 in 2009. Therefore, a need was arisen to provide a competency based syllabus for Combined Mathematics at G.C.E.(Advanced Level) syllabus the year 2009.

After implementing the Mathematics syllabus in 2009 it was revisited in the year 2012. In the following years teachers view's and experts opinion about the syllabus, was obtained and formed a subject comittee for the revision of the Mathematics syllabus by acommodating above opinions the committee made the necessary changes and revised the syllabus to implement in the year 2017.

The student who has learnt Mathematics at Grades 6-11 under the new curriculum reforms through a competency based approach, enters grade 12 to learn Mathematics at Grades 12 and 13 should be provided with abilities, skills and practical experiences for his future needs. and these have been identified and the new syllabus has been formulated accordingly. It is expected that all these competencies would be achieved by pupils who complete learning this subject at the end of Grade 13.

Pupils should achieve the competencies through competency levels and these are mentioned under each learning outcomes

It also specifies the content that is needed for the pupils to achieve these competency levels. The number of periods that are needed to implement the

process of Learning-Teaching and Assessment also mentioned in the syllabus.

Other than the facts mentioned regarding the introduction of the new curriculum, what had already been presented regarding the introduction of Combined Mathematics Syllabus earlier which are mentioned below too are valid.

- To decrease the gap between G.C.E. (Ordinary Level) Mathematics and G.C.E. (Advanced Level) Combined Mathematics.
- To provide a knowledge in Mathematics to follow Technological and other course at Tertiary level.
- To provide Mathematics knowledge for commercial and other middle level employment.
- To provide guidance to achieve various competencies on par with their mental activities and to show how they could be developed throughout life.

2.0 Common National Goals

The national system of education should assist individuals and groups to achieve major national goals that are relevant to the individual and society. Over the years major education reports and documents in Sri Lanka have set goals that sought to meet individual and national needs. In the light of the weaknesses manifest in contemporary educational structures and processes, the National Education Commission has identified the following set of goals to be achieved through education within the conceptual framework of sustainable human development.

I.   Nation building and the establishment of a Sri Lankan identity through the promotion of national cohesion, national integrity, national unity, harmony and peace, and recognizing cultural diversity in Sri Lanka's plural society within a concept of respect for human dignity.

II.   Recognizing and conserving the best elements of the nation's heritage while responding to the challenges of a changing world.

III.   Creating and supporting an environment imbued with the norms of social justice and a democratic way of life that promotes respect for human rights, awareness of duties and obligations, and a deep and abiding concern for one another.

IV.   Promoting the mental and physical well-being of individuals and a sustainable life style based on respect for human values.

V.   Developing creativity, initiative, critical thinking, responsibility, accountability and other positive elements of a well-integrated and balance personality.

VI.   Human resource development by educating for productive work that enhances the quality of life of the individual and the nation and contributes to the economic development of Sri Lanka.

VII.   Preparing individuals to adapt to and manage change, and to develop capacity to cope with complex and unforeseen situations in a rapidly changing world.

VIII.   Fostering attitudes and skills that will contribute to securing an honourable place in the international community, based on justice, equality and mutual respect.

3.0   Basic Competencies

The following Basic Competencies developed through education will contribute to achieving the above National Goals.

(i)   Competencies in Communication

Competencies in Communication are based on four subjects: Literacy, Numeracy, Graphics and IT proficiency.

Literacy :   Listen attentively, speck clearly, read for meaning, write accurately and lucidly and communicate ideas effectively.

Numeracy :   Use numbers for things, space and time, count, calculate and measure systematically.

Graphics :   Make sense of line and form, express and record details, instructions and ideas with line form and color.

IT proficiency :   Computeracy and the use of information and communication technologies (ICT) in learning, in the work environment and in personal life.

(ii)   Competencies relating to Personality Development

-       General skills such as creativity, divergent thinking, initiative, decision making, problem solving, critical and analytical thinking, team work, inter-personal relations, discovering and exploring;

-       Values such as integrity, tolerance and respect for human dignity;

-       Emotional intelligence.

(iii)   Competencies relating to the Environment

These competencies relate to the environment : social, biological and physical.

Social Environment :   Awareness of the national heritage, sensitivity and skills linked to being members of a plural society, concern for distributive justice, social relationships, personal conduct, general and legal conventions, rights, responsibilities, duties and obligations.

Biological Environment :   Awareness, sensitivity and skills linked to the living world, people and the ecosystem, the trees, forests, seas, water, air and life-plant, animal and human life.

Physical Environment :   Awareness, sensitivity and skills linked to space, energy, fuels, matter, materials and their links with human living, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, wastes and excretion.

Included here are skills in using tools and technologies for learning, working and living.

(iv)   Competencies relating to Preparation for the World of Work.

Employment related skills to maximize their potential and to enhance their capacity

to contribute to economic development,

to discover their vocational interests ad aptitudes,

to choose a job that suits their abilities, and

to engage in a rewarding and sustainable livelihood.

(v)   Competencies relating to Religion and Ethics

Assimilating and internalizing values, so that individuals may function in a manner consistent with the ethical, moral and religious modes of conduct in everyday living, selecting that which is most appropriate.

(vi)   Competencies in Play and the Use of Leisure

Pleasure, joy, emotions and such human experiences as expressed through aesthetics, literature, play, sports and athletics, leisure pursuits and other creative modes of living.

(vii)   Competencies relating to ' learning to learn'

Empowering individuals to learn independently and to be sensitive and successful in responding to and managing change through a transformative process, in a rapidly changing, complex and interdependent world.

4.0 Aims of the Syllabus

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

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

(iii)   To improve the students knowledge of logical thinking in 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 skill 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 centred.
- 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 Combined Mathematics.

5.0 Relationship between the Common National Goals and the Competencies of the Syllabus.

Competencies of the Syllabus - Mathematics I	Common National Goals						
	i	ii	iii	iv	v	vi	vii
1. Analyses the Real Number system	✓	✓	✓	✓	✓	✓	✓
2. Manipulates Algebra of Sets	✓	✓	✓	✓	✓	✓	✓
3. Manipulates Mathematical Logic	✓	✓	✓	✓	✓	✓	✓
4. Manipulates the methods of proofs to prove the mathematical results	✓	✓	✓	✓	✓	✓	✓
5. Analyses functions of a real variable	✓	✓	✓	✓	✓	✓	✓
6. Analyses polynomials	✓	✓	✓	✓	✓	✓	✓
7. Investigates rational functions, exponenttial functions and logarithmic functions	✓	✓	✓	✓	✓	✓	✓
8. Manupulates inequalities.	✓	✓	✓	✓	✓	✓	✓
9. Explores the binomial expansion for positive integral indices.	✓	✓	✓	✓	✓	✓	✓
10. Finds the sum of the finite series	✓	✓	✓	✓	✓	✓	✓
11. Ditermines the limit of the function	✓	✓	✓	✓	✓	✓	✓
12. Investigates straight lines in terms of cartesian co-ordinates	✓	✓	✓	✓	✓	✓	✓
13. Uses the derivatives of a function to solve problems.	✓	✓	✓	✓	✓	✓	✓
14. Finds indefinite and definite integrals of functions		✓	✓	✓	✓	✓	✓

✓

Competencies of the Syllabus - Mathematics II	Common National Goals						
	i	ii	iii	iv	v	vi	vii
1. Interprets the basics of statistics	✓	✓	✓	✓	✓	✓	✓
2. Presents data and information systematically	✓	✓	✓	✓	✓	✓	✓
3. Interprets the behaviour of a frequency distribution	✓	✓	✓	✓	✓	✓	✓
4. Analyses random phenomena mathematically	✓	✓	✓	✓	✓	✓	✓
5. Determines the optimum solution of a linear programming problem	✓	✓	✓	✓	✓	✓	✓
6. Uses Permutation and combination to solve mathematical problems	✓	✓	✓	✓	✓	✓	✓
7. Analyses projects by using networks	✓	✓	✓	✓	✓	✓	✓
8. Manipulates determinants as a mathematical model of solving problems	✓	✓	✓	✓	✓	✓	✓
9. Manipulates Matrix Algebra	✓	✓	✓	✓	✓	✓	✓

6.0 Proposed Term Wise Breakdown of the Syllabus
Grade - 12

Competency Level	Content	Number of Periods
Term I		
Mathematics -I		
1.1, 1.2,1.3	• Real number system	14
2.1,2.2	• Algebra of sets	12
3.1	• Mathematical logic	10
5.1, 5.2	• One variable functions	20
6.1, 6.2, 6.3, 6.4	• Polynomials	38
Mathematics -II		
1.1, 1.2	• Basics of Statistics	06
2.1, 2.2,2.3,2.4	• Data,data representation	10
Term II		
Mathematics -I		
12.1, 12.2, 12.3, 12.4,12.5	• Straight lines	30
7.1, 7.2	• Rational functions and logarithm	30
4.1	• Methods of proofs	12
Mathematics -II		
3.1,3.2	• Measures of central tendency	24
Term III		
Mathematics -I		
8.1, 8.2, 8.3	• Inequalities	24
11.1	• Limits	08
Mathematics -II		
3.3, 3.4,3.5, 3.6, 3.7	• Frequency distribution	23
4.1, 4.2	• Random experiments and probability	18
6.1, 6.2	• Permutation and combination	24

Grade - 13

Competency Level	Content	No. of Periods
	Term I	
Mathematics -I		
13.1, 13.2, 13.3, 13.4,13.5,13.6, 13.7	• Derivatives	40
Mathematics -II		
4.3, 4.4,4.5, 4.6, 4.7,4.8.4.9	• Probability	60
	Term II	
Mathematics -I		
14.1, 14.2, 14.3, 14.4, 14.5,14.6, 14.7	• Integration	40
Mathematics -II		
4.10	• Discreate probality distribution	20
5.1, 5.2	• Linear programing	25
8.1,8.2	• Deterninants	10
9.1, 9.2	• Matrices	20
	Term III	
9.1, 9.2	• Binomial expansion	16
10.1, 10.2, 10.3	• Series	26
Mathematics -II		
4.11	• Continuous probablity distribution	15
7.1,7.2	• Networks	25

Subject		Number of Periods	Total
Grade 12			
First Term			
Mathematics - I		94	
Mathematics - II		16	110
Second Term			
Mathematics - I		72	
Mathematics - II		24	96
Third Term			
Mathematics - I		32	
Mathematics - II		65	97
Grade 13			
First Term			
Mathematics - I		40	
Mathematics - II		60	100
Second Term			
Mathematics - I		40	
Mathematics - II		75	115
Third Term			
Mathematics - I		42	
Mathematics - II		40	82

7.0 Syllabus
Mathematics - I

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
1. Analyses the Real Number system.	1.1 Classifies the Real number system.	• Review of the real number system. • Notations for sets of numbers. • Geometrical representation of a real number.	• Writes correct notations for sets of numbers. • Represents real numbers geometrically.	04

	1.2 Uses surds and decimals to represents real numbers.	• Decimal representation of a real number.
		   • Finite decimals.
		   • Infinite decimals.
		   • Recurring decimals.
		 • Surds and expressions involving surds.
			• Classifies decimal numbers.
			 • Classifies real numbers.
			 • Rationalises the denominator of expressions with surds.
			 • Uses arithmetical operation on surds.
				04

	1.3 Uses Exponents (indices) and logariths to communicate real numbers.	• Positive integral Exponents (indices). • Negative integral and zero exponents. • Ratictional exponents. • Laws of indices. • Laws of logarithms	• Defines indicies. • Classifies positive integral exponents, negative integral exponets, zero exponents and fractial exponents. • States laws of indices. • States laws of logarithms • Applies laws of indicies and logarithms solves problems.	06

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

2. Manipulates Algebra of Sets.	2.1 Applies basic cocepts of sets to solve problems.	• Language of sets and elements of a set.
		  • Universal set, null set, finite set and infinite set and cardinality of a set.
		  • Subsets, proper subsets,equality of two sets, and Power set.
			• Explains set notations.
			• Explains and writes the notations of universal set and null set.
			• Explains finite sets and infinite sets.
			• Defines cardinality of a finite set and writes its notation.
			• Defines subsets, proper subsets. equality of two sets and power set.
				06

	2.2 Uses Venn diagrams and algebra of sets to solve problems.	• Set operations.
		  • Intersection and union.
		  • Complement, relative complement.
		  • Set identities.
		• Cardinality formula
		  • $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
		  • Extension to three events
			• States the set operations and illustrates with venn diagrams
			• Identify set identities
			• Solves problems involving set identities
			• Uses the cardiolity formula for two set and extend it to three sets.
				06

3. Manipulates Mathematical Logic.	3.1 Identify statements.	• Statements. • Logical connectives and compound statements. • Conditional statements. • Compound statements.	• Identifies statements. • Identifies the different types of statements. • Writes the definition of all types of statements.	10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• Construction of the truth table. • Logical equivalence. • Predicates. • Quantifiers.	• Defines conditional statements. • Defines compound statements. • Constructs truth tables. • States the definitions of logical equivalence • Introduces predicates • Defines quantifiers.	

4. Manipulates the methods of proofs to prove the mathematical results.	4.1 Proves Mathematical results by using direct proof, proof by contradiction, proof by contraposition and proof by mathematical induction.	• Methods of proof.
		  • Direct proof.
		  • Proof by contradiction.
		  • Proof by contraposition
		  • Proof by Mathematical induction.
			• States methods of proofs.
			• Describes direct proof, proof by contradiction proof of contraposition and proof by mathematical induction.
			• Solves problems using different methods of proofs.
				12

5. Analyses functions of a real variable.	5.1 Investigates functions.	• Introduces functions • Domain, range. • Graph of a function, vertical line test for a function. • Elementry functions	• Explains the defmition of a function • Explains domain and range of a function. • Sketches graphs. • Explain graph of a function	10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		$f(x) = ax + b,$ $f(x) = |x|, \; f(x) = x^2$ $f(x) = \dfrac{1}{x}, \; (x \neq 0)$ $f(x) = \sqrt{x}, \; (x \geq 0)$ $f(x) = \dfrac{1}{x^2}, \; (x \neq 0)$ • Graphing functions using translations. (shifting)	• Describes vertical line test for a function. • Recognizes special functions. • Sketches graphs of special functions. • Sketches graphs of functions using translations (shifting).	

	5.2 Investigates operations on functions.	• Basic operation +, -, ×, and ÷
		 • Composite functions.
		 • Inverse functions.
		  • Definition of inverse function.
		  • Finding the inverse of a function.
			• Performs basic operations on functions.
			 • Defines composite functions.
			 • Introduces the notations for composite functions.
			 • Defines inverse function.
			 • Finds the inverse of a function.
				10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

6. Analyses polynomials.	6.1 Investigates polynomials.	• Polynomials in one variable.
		  • Degree, leading term and leading coefficient.
		  • Equality of two polynomials.
			• Defines polynomial functions of a single variable.
			• Defines the terms degree, leading term and leading coefficient.
			• States the condition for two polynomials to be equal.
				15

	6.2 Uses mathematical operation involving polynomials.	• Mathematical operations involving polynomials.
		  • Addition, subtraction.
		  • Multiplication.
		  • Division, long division.
		  • Synthetic division by a linear expression.
		• Remainder theorem.
		• Factor theorem.
			• Manipulates the basic mathmatical operations on polynomilas.
			• Divides a polynomial by another polynomial.
			• States synthetic division.
			• States the remainder theorem.
			• Proves the remainder theorem.
			• States the factor theorem.
			• Expresses converse of the factor theorem.
			• Solves the problems using remainder theorem and factor theoram.
			• Solves polynomial equations. (up to 4th degree)
			• Defines zeros of a polynomial.
				10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	6.3 Investigates quadratic functions and their properties.	• Quadratic functions.
		  • Completing the square.
		  • Discriminant.
		  • Least value and greatest value.
		  • Sketching the graph.
		• Applications of quadraric functions
			• Introduces linear functions.
			• Explains quadratic functions.
			• Explains the properties of a quadratic function.
			• Sketches the graph of a quadratic function.
			• Describes different types of graph of quardratic functions
			• Solves problems involding quadratic functions.
				10

	6.4 Investigates quadratic equations.	• 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.
			• Explains the roots as α and β of a quadratic equation $ax^2 + bx + c = 0$
			• Finds the roots of a quadratic equation.
			• Describes the nature of the roots of a quadratic equation.
			• Expreses the sum and products of the roots of quadratic equations in terms of its coefficients.
			• Constructs quadratic equations.
				15

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• Solution of simultaneouss equations, of one equation is linear in two variables and the other equation is quadratic in one or both variables.	where roots are symmetric functions of α and β. • Solves problems involving quadratic equations.	

7. Investigates rational functions, exponential functions and lorarithms functions.	7.1 Resolution of a rational function into partial fractions.	• Rational functions.
		  • Proper rational functions.
		  • Improper rational functions.
		• Partial fractions.
		  • Partial fractions of proper rational functions.
		  • Partial fractions of improper rational functions.
			• Defines rational functions.
			• Defines proper rational functions and inproper rational functions.
			• Finds patial fractions of proper rational functions.
			• Finds partial fractions of improper rational functions.
			(not more than 4 unknowns are expected)
				15

	7.2 Analyses the Exponential and Logarithmic functions.	• Exponential function and its properties.
		  • Graphs of growth and decay of propulation.
		  • Definition of e
		  • Properties of e^x
		  • Graph of e^x
			• States the properties of exponential functions.
			• Sketches graph of exponential functions.
			• States the properties of e^x and draws its graph.
				15

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

		• Logarithmic function and its properties.
		     • Properties of *lnx*
		     • Change of base.
		     • Graph of *lnx*
		 • Examples on compound Interest, Population growth , radiation and pH values etc.
			• States the properties of *lnx*
			 • Writes change of base of a logarithmic function.
			 • Draws the graph of *lnx*
			 • Compares the relations between *lnx* and e^x
			 • Solves problems involving compound Interest, population growth using proper equation.	

8. Manupulates inequalities.	8.1 Solves problems involving linear and quadratic inequalities.	• Inequalities.
		     • Linear inequalities.
		     • Quadratic inequalities.
		 • Simultaneous linear inequalities.
			• Solves linear and quadratic inequalities.
			 • Solves Simultaneous linear inequalities.
				10

	8.2 Solves quadratic inqualites using graphical method.	• Quadratic inequalities using graphs.	• Solves quadratic inequalities using graphs.	06

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	8.3 Solves inequalities involving rational functions.	• Inequalities involving $\dfrac{f(x)}{g(x)}$ where $f(x)$ and $g(x)$ are polynomials of x (degree ≤ 2)	• Solves in inequalities involving $\dfrac{f(x)}{g(x)}$, where $f(x)$, $g(x)$ are polynomials of x (degree ≤ 2) (Graphical methods are not expected)	08
9. Explores the binomial expansion for positive integral indices.	9.1 Describes the basic properties of the binomial expansion.	• Expansion of $(a+b)^n$ expressing the coefficients in the form ^nC_r. • $(a+b)^n = \sum_{r=0}^{n} {}^nC_r\, a^{n-r}b^r$ • Applications of the binomial theorem.	• Defines ^nC_r • Expands $(a+b)^n$ using binomial theorem. • Writes the general term in the expansion of $(a+b)^n$. • Solves problems involving binomial expansions	08
	9.2 Applies binomial theorem.	• Expansion of $(1+x)^n$ • Application of the expansion of $(1+x)^n$.	• Expands $(1+x)^n$ using binomial theorem. • Writes the general term in the expansion of $(1+x)^n$. • Solves problems involding binomial expansion.	08

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
10. Finds the sum of the finite series.	10.1 Describes finite series and their properties.	• Series. • General term, Summation.	• Finds the general terms of arithmetic and geometric series. • Finds the sums of arithmetic and geometric series.	08
	10.2 Solves problems involving arithmetic and geometric series.	• Introduces "Sigma" notation. • $\sum_{r=1}^{n}(kU_r) = k\sum_{r=1}^{n}U_r$ • $\sum_{r=1}^{n}(U_r + V_r) = \sum_{r=1}^{n}U_r + \sum_{r=1}^{n}V_r$	• Writes the series in $\sum$ notation and find the sum. • Describes arithmetic and geometric series using sigma notation. • Solve problems involving arithmetic and geometric series.	08
	10.3 Finds sums of elementary series.	• $\sum_{r=1}^{n}r, \sum_{r=1}^{n}r^2, \sum_{r=1}^{n}r^3$ and their applications. • Difference Method of method • Convergence of infinite series • Intuitive idea of a limit.	• Proves and uses the formulae by principal of Mathematical Induction for values $\sum_{r=1}^{n}r, \sum_{r=1}^{n}r^2, \sum_{r=1}^{n}r^3$. • Applies the above formulae to find the summation of series. • Lines the method of difference to find sum of a series • Determines convergent / divergent of infinite series	10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
11. Ditermines the limit of the function.	11.1 Interpretes the limit of a function.	• Theorems on limits. • Proof of $\lim\limits_{x \to a} \left(\dfrac{x^n - a^n}{x - a} \right) = na^{n-1}$.	• States the intutive idea of a limit and theorem on limits. • Proves $\lim\limits_{x \to a} \left(\dfrac{x^n - a^n}{x - a} \right) = na^{n-1}$ where n is a rational number. • Applies the above theorem.	08
12. Investigates straight lines in terms of cartesian co-ordinates.	12.1 Describes the rectangular Cartesion coordinate systems.	• Rectangular Cartesian co-ordinates. • Co-ordinate axes, origin of co-ordinates, Quadrants, abcissa, ordinate.	• Plots points on a Cartesian plane.	01
	12.2 Finds the distance between two points and the area of a triangle.	• 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. • Straight line.	• Writes the formulae for the distance in between two points in a Cartesian plane. • Finds the co-ordinaties of a point which divides the line joining two given points at a given ratio. • Finds the area of a triangle when the vertices are given.	06

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	12.3 Describes the equation of a straight line.	• Inclination and gradient of a straight line (for straight lines not parallel to the x axis). • x-intercept, y-intercept of a straight line.	• Finds the gradiant of a straight line. • Finds x-intercept and y-intercept of a straight line.	06
	12.4 Interprets the equation of a straight line.	• Different forms of the equation of a straight line. • Point - gradient form $y - y_1 = m(x - x_1)$. • Gradient-Intercept form $y = mx + c$. • Two point form $y - y_1 = \dfrac{y_2 - y_1}{x_2 - x_1}(x - x_1)$ • Intercept form $\dfrac{x}{a} + \dfrac{y}{b} = 1$	• Obtains equation of straight lines in point - gradient form. • Obtains equation of straight lines in gradient intercept form . • Obtains equation of straight lines in two point form. • Obtains equation of straight lines in intercept form. • Obtains equation of straight lines in General form. $ax + bx + c = 0$ • Iterprets the general forms when $(i) a = 0$, $(ii) b = 0$, $(iii) c = 0$ • Obtains equation of straight lines according to the data given	12

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• General form $ax + by + c = 0$. • Interpretation of the general form when $(i)\,a = 0$, $(ii)\,b = 0$, $(iii)\,c = 0$. • Point of intersection of two straight lines.		
	12.5 Derives the equation of a straight line passing through the point of intersection of two given straight lines.	• Interpretation of the equation $U + \lambda V = 0$, where $U = 0$ and $V = 0$ are the equations of two intersecting straight lines. • Definition of the derivative of $f(x)$ at a point x_0 as	• Finds the coordinate of the point of intersection of two non parallel lines. • Interprets and uses the equation $U + \lambda V = 0$.	05
13. Uses the derivatives of a function to solve problems.	13.1 Interprets the derivative of a function.	$\lim_{h \to 0} \dfrac{f(x_0 + h) - f(x_0)}{h}$. • Limiting position of the line joining two points on a curve as the tangent	• Defines the derivative at a point. • Obtains the slope of a tangent line at a point on a curve.	04

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		to the curve. • Slope of the tangent line. • Rate of change as a derivative. • Derivatives of the functions x^n, e^x, $\ln|x|$.	• Describes rate of change as a derivative. • Applies rate of change.	
	13.2 Finds the derivatives of polynomials, exponential and logarithmic functions.		• Obtains the following formulae $$\frac{d}{dx}(x^n) = nx^{n-1} \; , \; \frac{d\left(e^x\right)}{dx} = e^x$$ and $\dfrac{d}{dx}(\ln|x|) = \dfrac{1}{|x|}$.	06
	13.3 Uses the formulae for the derivative of the sum, product and the quotient of two function.	• Rules for finding the derivatives of a sum, product and quotient of two functions and their applications. • Chain rule for composition of functions.	• Derives formulae for sum, product and quotient of two functions and applies to differentiate functions. • Uses above rules to solves problems.	05
	13.4 Uses the chain Rule to find the derivative.	• Increasing functions, Decreasing functions. • Stationary points of functions.	• Applies chain rule to find the derivative of composite functions.	06

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	13.5 Determines the behaviour of a function using derivatives.	• Local maximum and local minimum. • Sketching simple curves using derivatives. (horizontal and vertical asymptotes)	• Describes increasing and decreasing function by using differentiation. • Finds stationary points. • Finds local maximum and local minimum points.	04
	13.6 Sketches simple curves using derivatives.		• Describes vertical and horizontal asymtotes. • Sketches simple curves using derivative. (including vertical and horizontal asymptotes)	07
	13.7 Uses derivatives to solve problems involving related rates.	• Applications of related rates. • Antiderivatives and indefinite Integrals • Properties of intergrals.	• Solves problems involving related rates.	08
14. Finds indefinite and definite integrals of functions.	14.1 Identifies Integration as the reverse process of differentiation. (anti-derivative of function)	• $\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$. • $\int \lambda f(x)dx = \lambda \int f(x)dx$. • Integrals of standard functions x^{n}, e^{x}	• Finds intergrals using results of derivative. • Uses the theorems on integration.	04

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	14.2 Identifies integrals of standard functions and results of intergtation.	• Standard results in intergtation $$\int \left[f(x) \right]^{n} f^{/}(x)\,dx = \frac{\left[f(x) \right]^{n+1}}{n+1} + c$$ $$\int \frac{f'(x)}{f(x)}\,dx = \ln\left| f(x) \right| + c.$$ • Definite integrals.	• Finds integrals problems using standard results. • Uses the formula to find integral. • Uses partial fractions to find integral.	06
	14.3 Determines definite integrals using the fundermental theorem of calculus.	• $\displaystyle\int_{a}^{b} f(x)dx$ notation. • Integration of rational functions using partial fractions.	• States the fundermental theorem of calculus. • Finds the values of definite integrals. • Uses the properties of definite integrals	06
	14.4 Uses different methods for integration.	• Integration by parts	• Solves problems using partial fractions.	04
	14.5 Integration using the method of integration by parts.	• Uses of integrations. • Area under a curve.	• Uses integration by parts to find integrals.	04

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	14.6 Determines the area of a region bounded by curves using integration.	• Area between two curves. • Numerical integration . • ~~Trapezoidal rule.~~	• Uses definite integral to find area undera curve. • Uses definite integral to find area between two curves.	08

	14.7 Uses method of approximation to solve problems.	• Simpson's rule.	• Describes Trapezoidal rule.
			• Describes Simpson's rule.
			• Solves problems using.
			  • Trapezoidal rule.
			  • Simpson's rule.
				08

Mathematics - II

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

1. Interprets the basics of statistics.	1.1 Investigates the nature of statistics.	• Introduction to statistics.
		• Nature of statistics.
		  • Descriptive statistics.
		  • Inferential statistics.
		• Connection between inferential. Statistics and probability
		• Application of Statistics.
			• Explains statistics and its nature.
			• Explains probability and probability distribution theory.
			• Distinguish between descriptive statistics and inferential statistics.
			• Identifies the role of probability in inferential statistics.
			• Identifies some application of statistics.
				03

	1.2 Manipulates data to obtain information.	• Data and Information.
		• Experiments and Data.
		• Controlled Experiments censuses and surveys.
		• Types of Data.
		  • Qualitative and quantitative.
		  • Norminal and ordinal.
		  • Discrete data.
		  • Continuous data.
			• Explains data and information.
			• Explains controlled experiments censuses and surveys.
			• Explains the types of data.
				03

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

2. Presents data and information systematically.	2.1 Classifies data.	• Techniques of classifies data.
		  • Classification of data as a process of arranging objects.
		  • Aims of classification.
		  • Basis of classification.
			• Classifies data.
			• States aims and basic of classification of data.
				02

	2.2 Tabulates data.	• Techniques of tabulation.
		  • Construction of frequency table.
		    • Ungrouped frequency distribution.
		    • Grouped frequency distribution.
		  • Construction of two way tables.
		• Importance of tabulation.
			• Prepares ungrouped frequency distribution.
			• Prepares grouped frequency distribution.
			• Constructs two way tables.
			• Explains importance of tabulation.
				02

	2.3 Represents data and information using charts.	• Techniques of data representation.
		  • Importance of charts.
		  • Limitations and rules.
		  • Geometrical forms.
		    • Bar charts.
		    • Types of bar charts.
		    • Pie charts.
		    • Maps.
			• Identifies the significant of using charts.
			• Uses different types of charts to represent data.
			• Uses maps to represent data.
				03

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	2.4 Represents data and information graphically.	• Graphical techniqes (lines and curve forms).
		  • Line graphs.
		  • Line graphs for more than one variable.
		  • Histogram.
		  • Frequency polygon.
		  • Smooth frequency curves.
		  • Ogives or cumulative frequency curves.
			• Describes line graphs.
			• Draws histogram.
			• Draws frequency polygon.
			• Draws frequency curves.
			• Smooth frequency curves.
			• Draws cumulative frequency curves.
			• Solves problems by extracting information from graphs.
				03

3. Interprets the behaviour of a frequency distribution.	3.1 Analyses mean as a measure of central tendency.	• Mean for classified and unclassified data.
		  • weighted mean.
		  • geometric mean.
			• Finds mean for classified data.
			• Finds mean for unclassified data.
			• Finds weighted mean for unclassified data.
			• Finds geometric mean for unclassified data.
				10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	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.	• Finds median of frequency distribution. • Finds quartiles of frequency distribution. • Finds deciles of frequency distribution. • Finds percentiles of frequency distribution.	14
	3.3 Analyses mode as a measure of central tendency.	• Mode of a frequency distribution.	• Finds the mode of a frequency distribution. • Solves problems involving mode.	04
	3.4 Uses suitable measures of central tendency to reach decisions on frequency distributions.	• Relative importance of measures of central tendency.	• States the relative importance of measures of central tendency. • Selects a suitable measure of central tendency for given situations.	04

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	3.5 Describes distributions using measures of dispersion.	• Measures of dispersion.
		  • Range.
		  • Inter quartile range.
		  • semi interquartile range (Quartile deviation).
		  • Mean deviation.
		  • Variance.
		  • Standard deviation.
		• Importance of measures of dispersion.
		• Pool mean and pool variance.
		• Uses coding.
			• Describes the measures of dispersions and their importances.
			• Uses suitable measure of dispersion to make decision on frequency distribution.
			• Describes pool mean and pool variance.
			• Calculates pool mean and pool variance.
			• Uses coding to calculate variance.
			• Solves problems involving liner transformation.
				10

	3.6 Interprets coefficient of variation as a measures of dispersion.	• Coefficient of variation (Pierson).	• Explains coefficient of variation. • Solves problems involving coefficient of variation.	03

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	3.7 Decides on the shape of a distribution using measures of skewness.	• Measures of skewess.
		  • Karl Pearson's measures of skewness.
		  • $sk_1 = \dfrac{mean - mode}{Standard\ deviation}$.
		  • $sk_2 = \dfrac{3(mean - median)}{Standard\ deviation}$.
			• Defines the measure of skewness.
			• States relationship between mean, median and mode.
			• Finds measures of skewness.
			• Describes the shape of distribution using measures of skewness.
				02

4. Analyses random phenomena mathematically.	4.1 Determines the events of a random experiment.	• Experiments and events.
		  • Types of experiments.
		    • Deterministic experiments.
		    • Non-deterministic or expandom of experiments.
		    • Possible outcomes of an experiment.
		    • Sample space of an experiment.
		• Events.
		  • Types of events.
		    • Simple event, composite events, null event, complementary events.
			• Explains deterministic experiments.
			• Explains non-deterministic experiments.
			• Explains random experiments.
			• Defines sample space and sample points.
			• Defines events.
			• Explains types of events.
			• Classifies events.
			• Defines union and intersection of two events.
			• Explains mutually exclusive events and exhaustive events
				08

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• Union of two events, intersection of two events • Mutually exclusive events • Exhaustive events • Equally probable events • Event space	• Explains equally probable events • Explains event space • Solves problems involving above concepts.	

	4.2 Interprets probability.	• Probability
		  • Classical definition of probability
		  • Frequency approximation of probability
		  • Axiomatic definition of probability
		• Laws of Probability
		  • $P(A) = P(A \cap B) + P(A \cap B')$
		  • $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
			• States classical definition of probability and its limitation.
			• States the frequency approximation to probability.
			• States the axiomatic definition to probbility
			• Proves the theorems in probability using axiomatic definition.
			• Solves problems using axiomatic definition and laws of probability.
				10

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	4.3 Decides the possibility of an event in terms of conditional Probability.	• Definition.
		• Conditional Probability outcomes.
		• Chain rule.
		  • Chain rule for two events.
		  • Extension of the chain rule for more than two events.
			• Defines conditional probability.
			• States and proves the theorems on conditional probability.
			• Solves problems involving conditional probability.
			• Uses chain rule for more than two events.
				08

	4.4 Interprets the independence of two random events.	• Independence of two events. • Pairwise independence. • Mutually independentce.	• Defines independence of two events. • Defines pairwise independentce. • Defines mutually independent ofevents. • Uses independence of events to solve problems.	04
	4.5 Uses Baye's Theorem as a deduction of the Total Probability Theorem.	• Partition of a sample space. • Total probability Theorem . • Baye's Theorem.	• Defines partition of a sample space • States total probability theorem • Proves total probability theorem • States and proves Baye's theorem • Solves problems involing Baye's theorem	08

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	4.6 Interprets random variables.	- Random variable. - Possible values of a random variable. - Discrete and continuous random variables.	- Defines random variable. - Describes possible values of a random variable. - Defines discrete random variables. - Defines continuous random variables.	02
	4.7 Analyses the properties of a probability distribution of a continuous and a dicrete random variable.	- Probability distribution of a discrete random variable. - Probability distribution of a continuous random variable. - Probability mass function of a discrete random variable. - Probability density function of a continuous random variable.	- Describes probability distribution of a descriete random variable. - Describes probability distribution of a continuous random variable. - Describes probability mass function of a descrite random variable. - Describes probability density function of a continuous random variable.	12
	4.8 Interprets the mathematical expectation and variance of a random variable.	- Mathematical expectation of a random variable. - Mean. - Variance of a random variable	- Defines mathematical expectation of a discrete random variable. - Defines mathematical expectation of a continuous random variable. - Defines variance of a discreate random variable. - Defines variance of a continuous random variable.	12

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
	4.9 Determines the cumulative distribution function of a random variable.	● Cumulative distribution function (c.d.f) of a random variable.	● Defines Cumulative distribution function of discretes random variable ● Defines cumulative distribution function of a continuous random variable. ● Finds c. d. f. for a given probability mass function. ● Finds c. d. f. for a given probability denscity function. ● Plots c. d. f. for discrete random variable. ● Plots c. d. f. for continuous random variable.	14
	4.10 Constructs models for special discrete probability distributions, calculates probability and interpret it.	● Discrete probability distributions. • Bernoullis distribution. • Discrete uniform distribution. • Binomial distribution. • Poisson distribution.	● Describes Bernoullis distribution. ● Describes discrete uniform distribution. ● Describes binomial distribution. ● Describes Poissons distribution. ● Solves problems involving above distributions.	20

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	4.11 Claculates probability using theoritical models and interprets the density functions of special continuous distribution.	• Continuous probability distribution.
		  • Uniform distribution.
		  • Exponential distributions.
		  • Normal and standard normal distribution
			• Describes uniform distributions.
			• Describes normal distributions.
			• Describes standard normal distributions.
			• Solves problems involving above distributions.
				15

5. Determines the optimum solution of a linear programming problem.	5.1 Constructs a linear Programming model.	• Construction of a linear programming model.
		  • Decision variable.
		  • Objective function.
		  • Notation in standard form.
		  • Constraints.
		  • Non-negative conditions.
			• Constructs Linear Programming Models.
			• States decision variables.
			• Constructs objective functions.
			• Defines constraints.
			• States conditions.
				10

	5.2 Determines the solution of a linear programming problem graphically.	• Linear programming graphical solution.
		  • Feasible region.
		  • Solution of a maximising model.
		  • Solution of a minimising model.
			• Identifies the feasible region.
			• Finds the solutions of maximising model and minimising model.
			• Obtains feasible sulutions single solutions, and multiple solutions in problems.
			• Solves problelms involving linear programing	

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

		• Problems with.
		  • infeasible solutions.
		  • Single solution.
		  • Multiple solutions problems.
			• Obtains infeasible solutions, single solutions, and multiple solutions in problems.
			• Solves problems involving linear programming.
				15

6. Uses Permutation and combination to solve Mathematical problems.	6.1 Uses Permutations as a technique of solving mathematical problems.	• Fundamental principle of counting. • Classification by examples. • Factorial notation. • The number of permutations of n distinct objects taken $r(\leq n)$ at a time. • Symbol ^nP_r. • The number of permutations of r objects taken from n objects not all distinct.	• Explains the fundamental principle's of counting. • Defines the factorial. • States the recursive relation for factorial. • Defines ^nP_r and obtains the formulae for ^nP_r. • Finds the permutation of r objects taken from n objects all differents. • Finds the permutation of r objects aken from n objects not all differenct • Solves problems involving permutations.	10
	6.2 Uses combinations as a technique of solving Mathematical problems.	• Concept of combination. • The number of combination of n distinct object, taken r at a time.	• Defines combination. • Explains the difference between permutations and combinations.	

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• symbol and formula for ^nC_r $$^nC_r = \frac{n!}{r!(n-r)!}$$ • Properties of ^nC_r • $\quad ^nC_o = {}^nC_n = 1 \quad and$ • $\quad ^nC_r = {}^nC_{n-r}$ • $\quad ^{n+1}C_r = {}^nC_{r-1} + {}^nC_r$	• Defines ^nC_r • Finds a formula for ^nC_r • Applies the formulae to related problems. • States the properties of ^nC_r. • Finds numbers of combinations. of r objects taken from n objects all different. • Finds number of combinations of r objects taken trom n objects not all diffrent • Solves problems involving combinations	14
7. Analyses projects by using networks.	7.1 Describes net works.	• Networks. • Components of networks. • Network. • Arc. • Node. • Applications of network techniques.	• Defines networks • Identifies Components of networks. • Explains use of network techniques. • States advantages and limitations of network techniques.	10
	7.2 Solves problems by using network.	• Project planning. • Represents as networks. • Critical path.	• Represents projects by networks. • Explains critical path, minimum starting time, minimum finishing time,	

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• Minimum starting time. • Minimum finishing time. • Maximum starting time. • Maximum finishing time. ● Minimal spanning tree problem. ● Maximum flow problem.	maximum starting time, maximum finishing time. ● Finds critical path, minimum starting time, minimum finishing time, maximum starting time, maximum finishing time. ● Explains minimal spanning tree. ● Explains maximum flow. ● Solves problems involving minimal spanning tree. ● Solves problems involving maximum flow.	15
8. Manipulates Determinants as a mathematical model of solving problems.	8.1 Interprets the properties of determinants of order two and three.	● Introduction of determinants. ● 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.	● Defines determinant. ● Finds value of a determinant. ● States properties of determinant. ● Solves problems involving determinant and its properties.	04

Competency	Competency Level	Contents	Learning outcomes	No. of Periods
		• If k is common factor of all the elements in a row or a column, then k is a common factor of the determinant.		

9. Manipulates Matrix Algebra.	9.1 Describes Matrix Algebra.	• Definition and notation of matrices
		• Elements rows, cloumns, size of a matrix, row matrix and column matrix.
		• Matrix addition.
		  • Compartible for addition.
		  • Closure property.
		  • Commutative law and associative laws for addition.
		• Scalar multiplication.
		• Distributive law for addition over scalar multiplication.
			• Defines matrices.
			• Identify row, column and order of a matrix.
			• Identify row matrix , column matrix.
			• Describes compartible for addition of two matrices.
			• States closure property.
			• Uses commutative law and associative laws for addition.
			• Multiplies matrices by a scalar.
			• Uses distributive law for addition over scalar multiplication.
			• Solves problems involving matrices, addition.
				08

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

	9.2 Investigates the properties of square matrices.	• Matrix multiplication.
		  • Compatibility of matrices for multiplication.
		  • Multiplication is not commutative.
		• Square Matrices.
		  • Identify matrix.
		  • Diagonal matrix.
		• Algebra of square matrices.
		  • assiciativeness of matrices multiplication. $(AB)C = A(BC)$
		  • distributiveness for addition over matrices multiplication
		  $A(B+C) = AB + AC$
		  $(B+C)A = BA + CA$
		  • $IA = A = AI$ where I is a Identity matrix with order of A
		  • Zero metrix.
		• Invers of a metrix (Oney for 2 x 2)
			• Defines compartibility for multiplication of two matrices.
			• Defines multiplication of two matrices.
			• Verifies that $AB \neq BA$ for some matrices.
			
			• Verifies square matrices.
			• Defines identify matrix.
			• Defines diagonal matrix.
			• Explain the associativeness of matrices
			• Explain the distributiveness for addition over matrices multiplication.
			• Verifies the $IA = A = AT$ for all matrices. (where A and I are same order)
			• Defines Zero matrix "0"
			• Show the condition $A = 0$ or $B = 0$, is not nessasary for $AB = 0$.
			• Finds the inverse of a matria.
				12

Competency	Competency Level	Contents	Learning outcomes	No. of Periods

		• Transforce
		    • $(A+B)^T = A^T + B^T$
		    • $\left((A)^T\right)^T = A$
		    • $(kA)^T = k\,A^T$ where k is a scalar
		    • $(AB)^T = B^T\,A^T$
			• States what is the Transforce of a Matrix.
			 • Verifies the properties related to martix transformation.
			 • Solves problems involving matrix multiplication.	

8.0 Learning Teaching Stratergies

To facilitate the students to achieve the anticipated outcome of this course, a variety of teaching stategies must be employed. If students are to improve their mathematical communication, for example, they must have the opportunity to discuss interpretations, solution, 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 numerial, 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 in influenced by many factors, each of which needs to be considered in determining the most appropriate teaching strategies. Research suggests that the cltural 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.

9.0 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, connection, reasoning and problem solving. The latter four aims, ensure the enhancement of the thinking and behavioural process of childern.

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

- Collectin 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 institution.

In order to organise such activites 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 developin 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 aptitudis of different students.

10.0 Assesment 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 basis of school terms.

The First Examination under this syllabus will be held in 2019.

MATHEMATICAL SYMBOLS AND NOTATIONS

1. Set Notations

$\in$	an element
$\notin$	not an element
$\{x_1, x_2 ...\}$	the set with elements x_1, x_2...
$\{x / ...\}$ or $\{x : ...\}$	the set of all x such that...
$n(A)$	the number of elements in set A
$\varnothing$	empty set
ξ	universal set
A'	the complement of the set A
$\mathbb{N}$	the set of natural numbers, $\{1, 2, 3, ...\}$
$\mathbb{Z}$	the set of integers $\{0, \pm 1, \pm 2, \pm 3, ...\}$
$\mathbb{Z}^+$	the set of positive integers $\{1, 2, 3, ...\}$
$\mathbb{Q}$	the set of rational numbers

$\mathbb{R}$	the set of real numbers
$\mathbb{C}$	the set of complex numbers
$\subseteq$	a subset
$\subset$	a proper subset
$\nsubseteq$	not subset
$\not\subset$	not a proper subset
$\cup$	union
$\cap$	intersection
$[a, b]$	the colsed interval $\{x \in R : a \le x \le b\}$
$(a, b]$	the interval $\{x \in R : a < x \le b\}$
$[a, b)$	the interval $\{x \in R : a \le x < b\}$
(a, b)	the open interval $\{x \in R : a < x < b\}$

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2. Miscellaneous Symbols

$=$	equal
$\neq$	not equal
$\equiv$	identical or congruent
$\simeq$	approximately equal
$\propto$	proportional
$<$	less than
$\leqslant$	less than or equal
$>$	greater than
$\geqslant$	greater than
∞	infinity
$\Rightarrow$	if
$\Leftrightarrow$	if and only if (iff)

3. Operations

$a+b$	a plus b
$a-b$	a minus b
$a \times b$, $a \cdot b$	a multipllied by b
$a \div b$, $\dfrac{a}{b}$	a divided by b
$a:b$	the ratio between a and b
$\displaystyle\sum_{i=1}^{n} a_i$	$a_1 + a_2 + \ldots + a_n$
$\sqrt{a}$	the positive square root of the real number a
$|a|$	the modulus of the real number a
$n!$	n factorial for $n \in \mathbb{N} \cup \{0\}$
${}^{n}P_r = \dfrac{n!}{(n-r)!}$ $0 \le r \le n$	$n \in \mathbb{Z}^{+}$, $r \in \mathbb{Z}^{+} \cup \{0\}$
${}^{n}C_r = \dfrac{n!}{r!(n-r)!}$, $0 \le r \le n$	$n \in \mathbb{Z}^{+}$, $r \in \mathbb{Z}^{+} \cup \{0\}$

4. Functions

$f(x)$	the functin f of x
$f : A \rightarrow B$	f is a function under which each element of set A has an Image in set B
$f : x \rightarrow y$	the function f maps the element x to the elementy
f^{-1}	the inverse the function f
$g \circ f$	the composite function of f and g which is defined by $g \circ f(x)$
$\lim\limits_{x \to a} f(x)$	the limit of $f(x)$ as x tends to a
δx	an increment of x
$\dfrac{dy}{dx}$	the derivative of y with respect to x
$\dfrac{d^n y}{dx^n}$	then n^{th} derivative of y with respect to x
$f^{(1)}(x),\ f^{(2)}(x),\ ...,\ f^{(n)}(x)$	the first, second ,..., n$^{\text{th}}$ derivatives of $f(x)$ with respect to x
$\int y dx$	indefinite integral of y with respect to x
$\int_a^b y dx$	definite integral of y w.r.t x in the interval $a \le x \le b$
$\dot{x},\ \ddot{x},\ ...$	the first, second,... derivative of x with respect to time

5. Exponential and Logarithmic Functions

e^x	exponential function of x
$\log_a x$	logarithm to the base a of x
$\ln x$	natural logarithm of x
$\lg_x$	logarithm of x to base 10

6. Matrices

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

7. 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
$P(A \mid B)$	probability of the event A given the event B
X, Y, R, ...	random variables
$x, y, r, ...$ ect.	values of the random variables X, Y, R etc.
$x_1, x_2, ...$	observations
$f_1, f_2, ...$	frequencies with which the observations $x_1, x_2, ...$ occur
$\bigcup_{i=1}^{n} A_i = A_1 \cup A_2 \cup ... \cup A_n$	union of sets
$\bigcap_{i=1}^{n} A_i = A_1 \cap A_2 \cap ... \cap A_n$	intersection of sets
$\overline{x}$	Mean
σ^2	Variance
σ / S / SD	Standard deviation

8. Probability and Statistics

A, B, C etc ..	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
$P(A \mid B)$	probability of the event A given that event B is happened
X, Y, R, ...	random variables
x, y, r, ... ect.	values of the random variables X, Y, R etc.
x_1, x_2, ...	observations
f_1, f_2, ...	frequencies with which the observations x_1, x_2, ... occur
$\bigcup_{i=1}^{n} A_i = A_1 \cup A_2 \cup ... \cup A_n$	union of sets
$\bigcap_{i=1}^{n} A_i = A_1 \cap A_2 \cap ... \cap A_n$	intersection of sets
$\overline{x}$	arithmetric mean
σ^2	variance
σ / S / SD	standard deviation