SYLLABUS: 1 JANUARY 1994

REPUBLIC OF SOUTH AFRICA

CO-ORDINATOR: ENGINEERINGSTUDY

SYLLABUS FOR

MATHEMATICS N1

NATIONAL CERTIFICATE

CODE NUMBER

9211

EXAMINATION INSTRUCTION NO. 4 OF 1994

DATE OF IMPLEMENTATION
JANUARY 1994

DATE OF FIRST EXAMINATION
APRIL 1994

1. SUBJECT AIMS AND OBJECTIVES FOR MATHEMATICS

1.1 AIMS

Students should understand the mathematical principles taught in each module in such a way that they will be able to apply these principles in Engineering Science or the trade theories which they study.

1.2 OBJECTIVES

To teach the student in such a manner that, on completion of all the modules in Mathematics N1, he will be able to

* apply the mathematical principles mastered by him to his specific trade theory;
* use the correct mathematical terminology and to identify the appropriate formulae;
* use the correct SI units and derived units;
* commence with the study of Mathematics N2;
* apply the basic mathematical principles he has mastered in the working-place and in everyday life;
* reason logically when seeking solutions to mathematical and scientific problems; and
* function effectively in his working environment and to make sense of the extended technology that he is confronted with.

2. DURATION OF INSTRUCTIONAL OFFERING

The duration of this instructional offering is one trimester full-time (10 weeks/75 hours) or one trimester part-time (10 weeks/60 hours), which includes revision, tests and examinations.

3. EVALUATION

Candidates should be evaluated on a regular basis by conducting class tests on completion of each module.

4. EXAMINATION

4.1 Reproducing, application, analysing and evaluation are important aspects in order to determine the levels of difficulty in this subject, and the division thereof should be as follows:

REPRODUCING	APPLICATION	ANALYSING	EVALUATION
65	20	10	5

4.2 A paper of 3 hours to the value of 100 marks is set at the end of each trimester.

4.3 Only content classified as LEARNING OUTCOMES will be examined.

5. GENERAL INFORMATION

5.1 In order to bring the student, where possible, into contact with the situation in practice, problems must be taken from the practical situation.

5.2 The correct use of the suitable technical terminology must be stressed, especially in formulating definitions and principles.

5.3 Calculation answers must be approximated to three decimals. Approximation may not take place during calculations - only the final answer must be approximated.

5.4 When a standard formula is used in a calculation, the formula must be written down first before the values in the formula are substituted. If any manipulation is applied it must be clearly indicated.

5.5 Pocket calculators may be used in solving mathematical problems. Basic instruction must be offered in the practical use and operational abilities of the calculator.

5.6 The weight value (WV) indicates the time which should be spent to conclude a module as well as the approximate weight the module will carry in the examination.

5.7 Exposition of subject matter

The theme is preceded by the word MODULE, followed by a number indicating its chronological position. Decimal numbers indicate the CONTENT to be dealt with, and extended decimal numbers identify the expected LEARNING OUTCOMES.

6. SUBJECT MATTER

MODULE		WEIGHT VALUE
6.1	Exponents and logarithms	(15)
6.2	The four main operations	(8)
6.3	Factorisation	(17)
6.4	Equations and manipulations of technical formulae	(16)
6.5	Algebraic graphs	(13)
6.6	Triangles	(9)
6.7	Trigonometry	(8)
6.8	Mensuration and percentages	(14)
		(100)

7. DETAILED SYLLABUS

MODULE 1: EXPONENTS AND LOGARITHMS

1.1 EXPONENTS

On completion of this topic, the student should be able to:

1.1.1 Identify the sign, coefficient, radix and exponent of a power
1.1.2 Reproduce the laws for exponents
1.1.3 Apply the laws for exponents in simplifying algebraic expressions (the exponents may only be whole numbers).

1.2 LOGARITHMS

On completion of this topic, the student should be able to:

1.2.1 Define a logarithm
1.2.2 Give the following three laws of logarithms:
(i) $\log_a xy = \log_a x + \log_a y$
(ii) $\log_a x/y = \log_a x - \log_a y$
(iii) $\log_a x^n = n.\log_a x$,
where a = e, 2 and 10
1.2.3 Simplify simple logarithmic expressions without the pocket calculator
1.2.4 Carry out simple manipulations with logarithms with and without a pocket calculator.

DIDACTIC GUIDELINE

In calculations without the pocket calculator a is limited to 2, e and 10. All logarithms are limited to the base e for calculations at this stage. For calculations with logarithms pocket calculators only be may used to determine the logarithms.

MODULE 2: THE FOUR BASIC ALGEBRAIC OPERATIONS

2.1 THE POCKET CALCULATOR

On completion of this topic, the student should be able to:

2.1.1 Do calculations including the four basic operations, extraction of roots and involution with the aid of the pocket calculator
2.1.2 Use the memory keys in calculations
2.1.3 Use the special keys, e.g. INV, (), EXP, π, MODE, etc.

DIDACTIC GUIDELINE

The function keys, e.g. sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$,DRG, DEG, etc. should be discussed and practised as soon as those sections of the syllabus in which they figures, are introduced.

2.2 THE FOUR BASIC OPERATIONS

On completion of this topic, the student should be able to:

2.1.1 Add and subtract similar exponential terms
2.1.2 Multiply a monomial or a binomial expression by a monomial, binomial or trinomial expression, e.g.
(i) $3a(2a + 5c + 6)$
(ii) $(2a + 3)(3a + 6)$
(iii) $(2a + 3)(3a^2 + 6a + 7)$
2.1.3 Apply long division of a polynomial by a denominator not exceeding a binomial of the first degree, e.g.
$(3a^3 + 5a^2 + 6a + 7) \div (3a + 2)$.

MODULE 3: FACTORISATION, HCF, LCM AND ALGEBRAIC FRACTIONS

3.1 FACTORISATION

On completion of this topic, the student should be able to:

3.1.1 Factorise polynomials by looking for the common factor (limited to a monomial common factor)
3.1.2 Regroup terms that have a common factor.

3.2 HIGHEST COMMON FACTOR AND LOWEST COMMON MULTIPLE

On completion of this topic, the student should be able to:

3.2.1 Determine the HCF and LCM of not more than three numerical or monomial algebraic expressions by making use of factorisation.

3.3 ALGEBRAIC FRACTIONS

On completion of this topic, the student should be able to:

3.3.1 Do multiplication and division of fractions by using factorisation, keeping the set limitations in mind (fractions into fractions are excluded)
3.3.2 Add and subtract algebraic fractions by first factorising the numerator and denominator (polinomial numerators are excluded).

MODULE 4: EQUATIONS, WORD PROBLEMS AND MANIPULATION OF TECHNICAL FORMULAE

4.1 LINEAR EQUATIONS

On completion of this topic, the student should be able to:

4.1.1 Solve linear equations without any fractions.

4.2 WORD PROBLEMS

On completion of this topic, the student should be able to:

4.2.1 Set and solve linear equations from word problems (fractions in the equations are excluded).

4.3 MANIPULATION OF TECHNICAL FORMULAE

On completion of this topic, the student should be able to:

4.3.1 Change the subject of a given formula to any other subject. The following applications are ***excluded***:
- (i) Manipulation with exponents on a higher level than necessary for the Pythagorean theorem
- (ii) Manipulation by factorisation
- (iii) Manipulation by using the quadratic formula
- (iv) Manipulation by using the laws of logarithms

4.3.2 Determine the value of a new subject by substituting the values of the known quantities

4.3.3 Solve problems on distance, speed, time and revolutions.

DIDACTIC GUIDELINE

Only technical formulae may be given for manipulation.

MODULE 5: ALGEBRAIC GRAPHS

5.1 RECTANGULAR HYPERBOLA

On completion of this topic, the student should be able to:

5.1.1 Explain what the concept inverse relation means
5.1.2 Draw a rectangular hyperbola ($y = c/x$) with the aid of a table of function values (Ohm's law may be used as a practical example).

5.2 LINEAR GRAPHS

On completion of this topic, the student should be able to:

5.2.1 Explain what direct relation means
5.2.2 Write a linear equation of the form $y = mx + c$ in the form $f(x) = mx + c$ and identify the variables, constants and function values and calculate the function values, e.g. determine $f(-4)$ if $f(x) = 3x + 7$
5.2.3 Draw a linear graph ($y = mx + c$) with the aid of a table of function values with special reference to the choice and determining of a suitable scale
5.2.4 Determine the gradient and y-intercept from the graph.

DIDACTIC GUIDELINE

It is of the utmost importance to ensure that the student is able to determine a suitable scale.

MODULE 6: TRIANGLES

6.1 PROPERTIES OF TRIANGLES

On completion of this topic, the student should be able to:

6.1.1 Calculate an unknown interior angle of a triangle when the other two interior angles are given (the sum of the interior angles of a triangle is equal to 180°)
6.1.2 Write down the relation between an exterior angle and the opposite interior angles of a triangle and apply this relation in calculations on triangles
6.1.3 Name the properties of an isosceles triangle and apply these properties in simple numerical problems
6.1.4 Name the conditions for two triangles to be congruent
6.1.5 Draw similar triangles, write down the corresponding angles and calculate the ratio of the corresponding sides.

6.2 PYTHAGORAS' THEOREM

On completion of this topic, the student should be able to:

6.2.1 Calculate the unknown side of a right-angled triangle by applying Pythagoras' theorem
6.2.2 Construct a right-angled tringle by means of the 3,4,5-method.

DIDACTIC GUIDE-LINE

Proof of the theorems are not required.
The properties of the triangles should be confirmed experimentally and numerical examples and problems be given.

MODULE 7: TRIGONOMETRY

7.1 TRIGONOMETRIC FUNCTIONS

On completion of this topic, the student should be able to:

7.1.1 Determine the trigonometric ratio of a given angle
7.1.2 Determine the magnitude of the angle for a given ratio
7.1.3 Write down the three functions (sine, cosine and tangent) in terms of the sides of a given right-angled triangle with a given angle of reference
7.1.4 Solve a right-angled triangle with the aid of trigonometric functions
7.1.5 Sketch a sine curve by means of a circle with unit radius.

DIDACTIC GUIDELINE

The unit circle must be used to derive and define the trigonometric ratios sine, cosine and tangent.
The function keys of the pocket calculator needed for these calculations, should first be introduced.

MODULE 8: MENSURATION AND PERCENTAGES

8.1 MENSURATION

On completion of this topic, the student should be able to:

8.1.1 Convert units of length/distance, e.g. mm to m
8.1.2 Convert units of area, e.g. mm^2 to m^2
8.1.3 Convert units of volume, e.g. mm^3 to m3
8.1.4 Calculate the circumference of the following figures:
(i) Rectangle
(ii) Square
(iii) Triangle
(iv) Circle
8.1.5 Calculate the area/surface area of the following figures/objects:
(i) Rectangle
(ii) Square
(iii) Triangle
(iv) Circle
(v) Annulus
(vi) Parallelogram
(vii) Trapezium
(viii)Cylinder
8.1.6 Calculate the volume of the following objects:
(i) Right cylinder
(ii) Right cone
(iii) Sphere
(iv) Cube
(v) Right prism
(vi) Right pyramid

8.2 PERCENTAGES

On completion of this topic, the student should be able to:

8.2.1 Solve practical problems involving percentage calculations, e.g.
Calculate 13,5% of R55,00
8.2.2 Calculate percentage increases/decreases based on practical problems.

DIDACTIC GUIDELINE

Examination papers should not contain more than one problem on percentages.

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

SYLLABUS

FOR

MATHEMATICS N2

NATIONAL CERTIFICATE

CODE NUMBER

16030192

DATE OF IMPLEMENTATION

MAY 1997

DATE OF FIRST EXAMINATION

AUGUST 1997

Eksamination Instruction no. 1/97

1. SUBJECT AIMS AND OBJECTIVES FOR MATHEMATICS

1.1 AIMS

Students should understand the mathematical principles taught in each module in such a way that they will be able to apply these principles in Engineering Science or the trade theories which they study.

1.2 OBJECTIVES

To teach the student in such a manner that, on completion of all the modules in Mathematics N2, he will be able to

* apply the mathematical principles mastered by him to his specific trade theory;
* use the correct mathematical terminology and to identify the appropriate formulae;
* use the correct SI units and derived units;
* commence with the study of Mathematics N3;
* apply the basic mathematical principles he has mastered in the working-place and in everyday life;
* reason logically when seeking solutions to mathematical and scientific problems; and
* function effectively in his working environment and to make sense of the extended technology that he is confronted with.

2. DURATION OF INSTRUCTIONAL OFFERING

The duration of this instructional offering is one trimester full-time or one trimester part-time which includes revision, tests and examinations.

3. EVALUATION

Candidates should be evaluated on a regular basis by conducting class tests on completion of each module.

4. EXAMINATION

4.1 Reproducing, application, analysing and evaluation are important aspects in order to determine the levels of difficulty in this subject, and the division thereof should be as follows:

REPRODUCING	APPLICATION	ANALYSING	EVALUATION
55	20	15	10

4.2 A paper of 3 hours to the value of 100 marks is set at the end of each trimester.

4.3 Only content classified as **LEARNING OUTCOMES** will be examined.

5. GENERAL INFORMATION

5.1 In order to bring the student, where possible, into contact with the situation in practice, problems must be taken from the practical situation.

5.2 The correct use of the suitable technical terminology must be stressed, especially in formulating definitions and principles.

5.3 Calculation answers must be approximated to three decimals. Approximation may not take place during calculations - only the final answer must be approximated.

5.4 When a standard formula is used in a calculation, the formula must be written down first before the values in the formula are substituted. If any manipulation is applied it must be clearly indicated.

5.5 Pocket calculators may be used in solving mathematical problems. Basic instruction must be offered in the practical use and operational abilities of the calculator.

5.6 The weighted value (WV) indicates the time which should be spent to conclude a division (module) as well as the approximate weight the division (module) will carry in the examination.

5.7 Exposition of subject matter

The theme is preceded by the word **MODULE**, followed by a number indicating its chronological position. Decimal numbers indicate the **CONTENT** to be dealt with, and extended decimal numbers identify the expected **LEARNING OUTCOMES**.

6. SUBJECT MATTER

MODULE	WEIGHTED VALUE	
6.1 Exponents and logarithms	(15)	
6.2 Factorisation, HCF, ICM and algebraic fractions	(20)	
6.3 Equations, word problems and manipulations of technical formulae	(14)	
6.4 Algebraic graphs	(12)	
6.5 Measuring of angles, angular and circumferential velocity and sectors of circles	(12)	
6.6 Trigonometry	(15)	
6.7 Mensuration	(12)	(100)

7. DETAILED SYLLABUS

MODULE 1 : EXPONENTS AND LOGARITHMS

1.1 EXPONENTS

On completion of this topic, the student should be able to:

1.1.1 Reproduce the laws for exponents and their derivatives
1.1.2 Apply the laws for exponents and the derivatives in simplifying algebraic expressions
1.1.3 Solve exponential equations, limited to single term equations, e.g.

(i) $x^{\frac{1}{2}} = 4$
(ii) $3.2^x = 24$

1.2 LOGARITHMS

On completion of this logic, the student should be able to:

1.2.1 Define a logarithm
1.2.2 Give three laws of logarithms, e.g.

(i) $\log_a xy = 10g_a x + \log_a y$
(ii) $\log_a x/y = 10g_a x - \log_a y$
(iii) $\log_a x^m = m.\log_a x$
iv) $\log_a b = \log_c b/\log_c a$

1.2.3 Simply logarithmic expressions by using the laws of logarithms, e.g.

(i) $\log_8 2 + \log_8 4$
(ii) $\log_2 8 \times \log_8 6$

1.2.4 Do calculations by using logarithms which are limited to simple multiplication, division, involution and evolution by means of a pocket calculator. e.g.

$$\frac{A^x \times \sqrt{B}}{C \times D}$$

1.2.5 Change the radix of a logarithm to, for example, 2, 8, e or 10.

DIDACTIC GUIDELINE
ONLY POCKET CALCULATORS MAY BE USED TO DETERMINE THE VALUE OF LOGARITHMS

MODULE 2: FACTORISATION, HCF, LCM AND ALGEBRAIC FRACTIONS

2.1 FACTORISATION

On completion of this topic, the student should be able to:

2.1.1 Factorise a polynomial by taking out a common factor as a first step followed by taking out a binomial as common factor as a second step e.g.

$3a+ 3b + 5ac + 5bc$ or $3a + 3b - 5ac - 5bc$
$= 3(a + b) + 5c(a + b)$ $= 3(a + b) - 5c(a + b)$
$= (a + b)(3 + 5c)$ $= (a + b)(3 - 5c)$
(Grouping is limited to a maximum of four terms)

2.1.2 Factorise a quadratic trinomial of which the coefficient of x^2 is any whole number.

2.1.3 Factorise the difference to two squares.

2.2 HIGHEST COMMON FACTOR AND LOWEST COMMON MULTIPLE

On Completion of this topic, the student should be able to:

2.2.1 Determine the HCF and LCM of two, three or four algebraic expressions by making use of factorisation, keeping the limitations mentioned in 2.1 in mind.

2.3 ALGEBRAIC FRACTIONS

On completion of this topic, the student should be able to:

2.3.1 Do multiplication and division of fractions by using factorisation, keeping the set limitations in mind (fractions into fractions are excluded)

2.3.2 Add and subtract algebraic fractions by first factorising the numerator and denominator. No change in signs must be required to simplify the LCM, and the numerator of fractions may not exceed a binomial.

MODULE 3: EQUATIONS, WORD PROBLEMS AND MANIPULATION OF TECHNICAL FORMULAE

3.1 LINEAR EQUATIONS

On completion of this topic, the student should be able to:

3.1.1 Solve linear without fractions.

3.2 QUADRATIC EQUATIONS

On completion of this topic, the student should be able to:

3.2.1 Solve quadratic equations according to a specified method, i.e. factorisation or the quadratic formula. In the case of factorisations as set out in Module 2 will apply. In the case of the quadratic formula the coefficient of x^2 may be larger than +1 (only integers).

DIDACTIC GUIDELINE

Students should be shown the derivation of the quadratic formula, although the derivation will not be examined.

3.3 SIMULTANEOUS LINEAR EQUATIONS

On completion of this topic, the student should be able to:

3.3.1 Solve simultaneous linear equations with two unknown quantities. No fractions may occur in the equations.

3.4 WORD PROBLEMS

On completion of this topic, the student should be able to:

3.4.1 Set and solve linear equations from word problems. (Fractions in the equations are excluded).

3.5 MANIPULATION OF TECHNICAL FORMULAE

On completion of this topic, the student should be able to:

3.5.1 Change the subject of a given formula to any other subject. The following applications are ***excluded***:

(i) Manipulation by factorisation

(ii) Manipulation by using the quadratic formula

(iii) Manipulation by using the laws of logarithms

3.5.2 Determine the value of a new subject by substituting the values of the known quantities in the equation.

MODULE 4: ALGEBRAIC GRAPHS

4.1 LINEAR GRAPHS

On completion of this topic, the student should be able to:

4.1.1 Calculate the function values in a specific point for a given linear equation

4.1.2 Draw a linear graph with the aid of the following:

(i) gradient ordinate (offset) method;

(ii) gradient and Y-intercept method; and
(iii) X and Y intercept method.

4.2 PARABOLA

On completion of this topic, the student should be able to:

4.2.1 Draw the parabola (for a = ±1 only) by means of the table method or the following pre-calculations:

(i) The Y-intercept of the parabola

(ii) The roots of the parabola

(iii) The axis of symmetry of the parabola

(iv) The co-ordinates of the turning point of the parabola.

4.3 SOLUTIONS

On completion of this topic, the student should be able to:

4.3.1 Read values from the graphs in 4.1 and 4.2

4.3.2 Do graphic solutions of two equations of which both are linear or one is quadratic and the other linear.

MODULE 5: MEASURING OF ANGLES, ANGULAR AND PERIPHERAL VELOCITY AND SECTORS OF CIRCLES

5.1 Measuring of ANGLES

On completion of this topic, the student should be able to:

5.1.1 Write down the relation between degrees and minutes

5.1.2 Convert degrees and minutes to degrees and a decimal of a degree and vice versa.

5.2 RADIANS

On completion of this topic, the student should be able to:

5.2.1 Define a radian

5.2.2 Indicate the relationship between degrees and radians

5.2.3 Convert 1 radian to degrees

5.2.4 Convert degrees and minutes to radians and radians to degrees and minutes.

5.3 ANGULAR VELOCITY AND PERIPHERAL VELOCITY

On completion of this topic, the student should be able to:

5.3.1 Define the concepts angular and peripheral velocity

5.3.2 Convert revolutions per minute to revolutions per second and vice versa

5.3.3 Express angular velocity in radians per second

5.3.4 Convert peripheral velocity to angular velocity and vice versa

5.3.5 Do calculations with angular and peripheral velocities.

5.4 CIRCLE SECTORS

On completion of this topic, the student should be able to:

5.4.1 Explain what the **concept circle** means

5.4.2 Calculate the area of a circle sector when the following are known:

(i) The angle and radius of the sector

(ii) The angle and arc length of the sector

(iii) The radius and arc length of the sector.

5.4.3 Calculate the radius and the arc length of the circle sector as well as the angle which is subtended by the arc length

5.5 CHORDS IN A CIRCLE

On completion of this topic, the student should be able to:

5.5.1 Describe what the concepts **chord** and **circle segment** mean

(i) diameter of a circle when the length of the chord and the height of segment are given;

(ii) length of the chord when the diameter of the circle and the height of the segment are known; and

(iii) height of the segment when the diameter of the circle and the length of the segment are known.

MODULE 6: TRIGONOMETRY

6.1 TRIGONOMETRIC RATIOS

On completion of this topic, the student should be able to:

6.1.1 Define the six trigonometric ratios in terms of the unit circle

6.1.2 Write down the six trigonometric ratios in terms of the sides of a given right-angled triangle with a given angle of reference in any of the four quadrants

6.1.3 Solve a right-angled triangle with the aid of trigonometric functions

6.1.4 Calculate inaccessible elevations and depressions by means of trigonometric functions (combinations of two right-angled triangles are included and all calculations are limited to right-angled triangles)

6.1.5 Convert degrees and minutes to degrees and vice versa.

6.2 GRAPHS OF TRIGONOMETRIC FUNCTIONS

On completion of this topic, the student should be able to:

6.2.1 Draw trigonometric graphs from a table with 0° to 360° intervals. The following types of graphs are included.

(i) $y = \sin x$; $y = \cos x$

(ii) $y = a.\sin x$; $y = a.\cos x$ - change amplitude

(iii) $y = \sin x \pm c$; $y = \cos x \pm c$ - move the graph up/down

6.2.2 Read values from the above-mentioned graphs.

MODULE 7: MENSURATION

7.1 SURFACE AREA AND VOLUME

On completion of this topic, the student should be able to:

7.1.1 Calculate the surface area of the following objects:

(i) Cone
(ii) Cylinder
(iii) Sphere

7.1.2 Calculate the volume of the following objects

(i) Cone
(ii) Cylinder
(iii) Sphere

7.1.3 Determine the area of an irregular figure using the mid-ordinate rule.

DIDACTIC GUIDELINE

The calculation of area and volume should be based on practical examples, where possible.

SYLLABUS: 1 JANUARY 1994

REPUBLIC OF SOUTH AFRICA

CO-ORDINATOR: ENGINEERINGSTUDY

SYLLABUS FOR

MATHEMATICS N3

NATIONAL CERTIFICATE

CODE NUMBER

9213

EXAMINATION INSTRUCTION NO. 4 OF 1994

DATE OF IMPLEMENTATION
AUGUST 1994

DATE OF FIRST EXAMINATION
NOVEMBER 1994

1. SUBJECT AIMS AND OBJECTIVES FOR MATHEMATICS

1.1 AIMS

Students should understand the mathematical principles taught in each module in such a way that they will be able to apply these principles in Engineering Science or the trade theories which they study.

1.2 OBJECTIVES

To teach the student in such a manner that, on completion of all the modules in Mathematics N3, he will be able to

* apply the mathematical principles mastered by him to his specific trade theory;
* use the correct mathematical terminology and to identify the appropriate formulae;
* use the correct SI units and derived units;
* commence with the study of Mathematics N4;
* apply the basic mathematical principles he has mastered in the working-place and in everyday life;
* reason logically when seeking solutions to mathematical and scientific problems; and
* function effectively in his working environment and to make sense of the extended technology that he is confronted with.

2. DURATION OF INSTRUCTIONAL OFFERING

The duration of this instructional offering is one trimester full-time (10 weeks/75 hours) or one trimester part-time (10 weeks/60 hours), which includes revision, tests and examinations.

3. EVALUATION

Candidates should be evaluated on a regular basis by conducting class tests on completion of each module.

4. EXAMINATION

4.1 Reproducing, application, analysing and evaluation are important aspects in order to determine the levels of difficulty in this subject, and the division thereof should be as follows:

REPRODUCING	APPLICATION	ANALYSING	EVALUATION
40	25	20	15

4.2 A paper of 3 hours to the value of 100 marks is set at the end of each trimester.

4.3 Only content classified as LEARNING OUTCOMES will be examined.

5. GENERAL INFORMATION

5.1 In order to bring the student, where possible, into contact with the situation in practice, problems must be taken from the practical situation.

5.2 The correct use of the suitable technical terminology must be stressed, especially in formulating definitions and principles.

5.3 Calculation answers must be approximated to three decimals. Approximation may not take place during calculations - only the final answer must be approximated.

5.4 When a standard formula is used in a calculation, the formula must be written down first before the values in the formula are substituted. If any manipulation is applied it must be clearly indicated.

5.5 Pocket calculators may be used in solving mathematical problems. Basic instruction must be offered in the practical use and operational abilities of the calculator.

5.6 The weight value (WV) indicates the time which should be spent to conclude a module as well as the approximate weight the module will carry in the examination.

5.7 Exposition of subject matter

The theme is preceded by the word MODULE, followed by a number indicating its chronological position. Decimal numbers indicate the CONTENT to be dealt with, and extended decimal numbers identify the expected LEARNING OUTCOMES.

6. SUBJECT MATTER

MODULE		WEIGHT VALUE
6.1	Factors and fractions	(19)
6.2	Exponents, surds and logarithms	(13)
6.3	Equations, word problems and manipulations	(14)
6.4	Geometry of co-ordinates	(18)
6.5	Algebraic graphs	(9)
6.6	Differential calculus	(7)
6.7	Trigonometry	(20)
		(100)

7. DETAILED SYLLABUS

MODULE 1: FACTORS AND FRACTIONS

1.1 THE COMMON FACTOR

DIDACTIC GUIDELINE

Before the presentation of this topic, grouping must first be revised.

On completion of this topic, the student should be able to:

1.1.1 Factorise polynomials by looking for the common factor.

1.2 THE QUADRATIC TRINOMIAL

On completion of this topic, the student should be able to:

1.2.1 Factorise a quadratic trinomial. There are no limitations on any of the terms. A common factor may also be included, e.g. $3a^2 + 6ab + 3b^2$.

1.3 THE DIFFERENCE OF TWO SQUARES

On completion of this topic, the student should be able to:

1.3.1 Factorise the difference of two squares. The two squares may be not more than binomials, while a common factor may also be included, e.g.

(i) $3a^2 - 27b^2$
$= 3(a^2 - 9b^2)$
$= 3(a - 3b)(a + 3b)$

(ii) $25 - (a + b)^2$
$= [5 - (a + b)][5 + (a + b)]$

1.3.2 Solve quadratic equations by completing the square

1.3.3 Derive the quadratic formula by completing the square.

1.4 CUBE FUNCTIONS

On completion of this topic, the student should be able to:

1.4.1 Apply the residue and factor theorems to cube functions.

1.5 ALGEBRAIC FRACTIONS

On completion of this topic, the student should be able to:

1.5.1 Do multiplication and division of algebraic fractions by first factorising the numerators and denominators

1.5.2 Add and subtract algebraic fractions (the limitations on numerators and denominators are the same as for factorisation. Changing of the signs after factorisation is included to make it easier to determine the LCF.)

1.5.3 Simplify fractions over fractions where there are only a maximum of two fractions in the numerator and/or the

denominator (the fractions may contain constants or variables), e.g. $\frac{a/b + c/d}{d/c - c/b}$.

MODULE 2: EXPONENTS, SURDS AND LOGARITHMS

2.1 EXPONENTS

On completion of this topic, the student should be able to:

2.1.1 Apply the laws of exponents and their derivatives to solve algebraic expressions (the exponents may be positive or negative integers or positive or negative fractions.)

2.1.2 Solve equations of the following forms in which the radices are only positive real numbers, e.g.
(i) $3x^{1/3} = 27$
(ii) $3^{x^2 + 5x + 6} = 1$
(iii) $2^x + 3.2^x = 12$ - Common factor.

DIDACTIC GUIDELINE

Equations of the type $3^{2x} + 5.3^x - 14 = 0$ which must be solved by factorisation (quadratic trinomial) are excluded.

2.2 SURDS

On completion of this topic, the student should be able to:

2.2.1 Simplify expressions with surds by using the rules of the four basic operations, factorisation and involution

2.2.2 Rationalise fractions with irrational numerators (surds in the numerators) where the irrational numerators may only be monomials

2.2.3 Solve equations containing surds where only equations in which it is necessary to square once are allowed, e.g. $\sqrt{(x + 5)} = x + 2$

2.2.4 Solve equations which can be converted to quadratic equations, e.g.

$$\frac{1}{2x - 1} + \frac{x}{2x + 1} = \frac{2}{4x^2 - 1}.$$

DIDACTIC GUIDELINE

All radices are limited to positive real numbers.

2.3 LOGARITHMS

On completion of this topic, the student should be able to:

2.3.1 Reproduce the four laws of logarithms, viz.
(i) $\log_a xy = \log_a x + \log_a y$
(ii) $\log_a x/y = \log_a x - \log_a y$
(iii) $\log_a x^m = m.\log_a x$
(iv) $\log_a b = \log_c b/\log_c a$

2.3.2 Apply the laws of logarithms to simplify expressions

2.3.3 Solve logarithmic equations in which the natural logarithm $\log_e x$ or ln x appears, with specific reference to the change in the radix.

MODULE 3: EQUATIONS, WORD PROBLEMS AND MANIPULATIONS OF TECHNICAL FORMULAE

3.1 EQUATIONS

On completion of this topic, the student should be able to:

3.1.1 Solve linear equations containing fractions
3.1.2 Solve simultaneous linear equations containing fractions
3.1.3 Solve quadratic equations by means of the quadratic formula or factorisation, keeping the limitations which apply to factorisation in mind
3.1.4 Solve simultaneous equations of which one is linear and the other one is quadratic, in an algebraic manner.

3.2 WORD PROBLEMS

On completion of this topic, the student should be able to:

3.2.1 Set and solve quadratic and/or linear equations from word problems - the equations may not both be quadratic.

3.3 MANIPULATION OF TECHNICAL FORMULAE (CHANGING THE SUBJECT OF THE FORMULAE)

On completion of this topic, the student should be able to:

3.3.1 Change the subject of a given formula to any other required subject. The following applications are *included*:

(i) Manipulation of exponents, e.g.
$T = ar^{n-1}$ (n)

(ii) Manipulation by factorisation, e.g.
$E = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$ (m)

(iii) Manipulation by using the quadratic formula, e.g.
$s = ut + \frac{1}{2}at^2$ (t)

(iv) Manipulation of cubes, squares, square roots and cube roots

3.3.2 Determine the value from advanced technical formulae by manipulation and substitution.

MODULE 4: GEOMETRY OF CO-ORDINATES

4.1 THE STRAIGHT LINE

On completion of this topic, the student should be able to:

4.1.1 Find the equation of a straight line if one of the following sets of information is given:
- (i) A point on the line and the gradient of the line
- (ii) Two points on the line
- (iii) The equation of a line parallel to the required line and a point on the line
- (iv) The equation of a line perpendicular to the required line and a point on the line

4.1.2 Write the calculated equation of the line in the following manners:
- (i) Common form: $ay + bx + c = 0$
- (ii) Gradient offcut form: $y = mx + c$
- (iii) Intercept form: $x/a + y/b = 1$
- (iv) Gradient point form: $m = (y - y_1)/(x - x_1)$
- (v) Two-point form: $(y-y_1)/(x-x_1) = (y_2-y_1)/(x_2-x_1)$

4.1.3 Determine the length of a line segment between two given points

4.1.4 Determine the angle of inclination of a straight line

4.1.5 Determine the gradient of a straight line from a given angle of inclination

4.1.6 Determine the co-ordinates of the midpoint of a given line segment

4.1.7 Determine the equation of a circle with its centre at the origin and given radius

4.1.8 Determine the points of intersection of a given circle (centre at origin) and a straight line

4.1.9 Determine the equation of a tangent in a given direction to the circle

4.1.10 Determine the equation of a tangent to the circle at a specified point on the circumference of the circle.

MODULE 5: ALGEBRAIC GRAPHS

5.1 SKETCH GRAPHS

On completion of this topic, the student should be able to:

5.1.1 Draw the following graphs if the equations are given:
- (i) The straight line: $y = mx + c$
- (ii) The circle: $y = \pm\sqrt{(r^2 - x^2)}$ [r^2 a complete square]
- (iii) Semi-circles
- (iv) The rectangular hyperbola: $xy = a$
- (v) The parabola: $y = ax^2 + bx + c$ and $x = ay^2$
- (vi) The ellipse: $x^2/a^2 + y^2/b^2 = 1$
- (vii) The cube function $y = ax^3 + bx^2 + cx + d$, where $d = 0$, or if $d \neq 0$, then there should be at least one root ≤ 0 and an integer.

N.B. Where applicable, the intercepts with the axes should be shown.

5.2 GRAPHIC SOLUTIONS

On completion of this topic, the student should be able to:

5.2.1 Graphically solve simultaneous equations of any two graphs mentioned in 5.1.1

5.2.2 Draw the graph of $y = ax^n$ and indicate the influence on the form of the graph with changes in the values of a and n.

MODULE 6: DIFFERENTIAL CALCULUS

6.1 AVERAGE GRADIENT AND AVERAGE SPEED

On completion of this topic, the student should be able to:

6.1.1 Calculate the average gradient of a curve between the points (x_1,y_1) and (x_2,y_2) from $M_{ave} = y_2 - y_1/x_2 - x_1$

6.1.2 Calculate the average speed of an object

6.2 LIMITS

On completion of this topic, the student should be able to:

6.2.1 Determine the $\lim_{h\to 0} \frac{f(x + h) - f(x)}{h}$, where f must be chosen from the following functions: k, ax, ax + b and ax^2

6.2.2 Indicate that the following symbols denoting the derivative of a function, all have the same meaning: D_x, d/dx and f'(x), and if y = f(x), then dy/dx.

6.3 RULES FOR DIFFERENTIATING

On completion of this topic, the student should be able to:

6.3.1 Indicate the following rules for differentiating, and apply them to simple problems:
(i) $D_x[x^n] = nx^{n-1}$, n a real number
(ii) $D_x[f(x) \pm g(x)] = D_x[f(x) \pm D_x[g(x)]$
(iii) $D_x[kf(x)] = kD_x[f(x)]$

6.3.2 Determine the gradient of a curve at any point of the curve

6.3.3 Calculate the turning points of polynomials of at most the third degree and make a sketch of the curve (maxima, minima and points of inflection are excluded). Polynomials of the third degree will contain no constant, thus $y = ax^3 + bx^2 + cx$.

DIDACTIC GUIDELINE

An intuitive approach to the concept of a limit should be adopted when this theme is first introduced to the students. All the rules for differentiating are accepted without proof.

MODULE 7: TRIGONOMETRY

7.1 EQUATIONS AND EXPRESSIONS

On completion of this topic, the student should be able to:

7.1.1 Solve linear trigonometric equations for angles in one revolution (equations with a common factor are included.)

7.1.2 Simplify trigonometric expressions by using exact values

7.1.3 Solve acute-angled and obtuse-angled triangles which result from the application of inaccessible heights and distances by making use of the sine, cosine and the area rules

7.1.4 Simplify trigonometric expressions by applying inverse, quotient and square identities.

7.2 GRAPHS

On completion of this topic, the student should be able to:

7.2.1 Draw sketch graphs of the following trigonometric functions by making use of the amplitude period method:

(i) $y = a.\sin x$
(ii) $y = a.\cos x$
(iii) $y = \sin bx$
(iv) $y = \cos bx$
(v) $y = a.\sin bx$
(vi) $y = a.\cos bx$
(vii) $y = a.\sin (bx + c)$
(viii) $y = a.\cos (bx + c)$

7.2.2 Read approximate values from the graph after it has been drafted - limited to not more than two graphs on the same axial system

7.2.3 Develop sinusoidal waveforms from a vector rotating with an angular velocity of ω radians per second

7.2.4 Combine two trigonometric waves (functions) on the same axial system.