5.1.0   MATHEMATICS I

5.1.1   Introduction
This module unit is designed to equip the trainee with the relevant mathematical knowledge, skills techniques and attitudes necessary to enhance better understanding of construction principles.

5.1.2   General Objectives
By the end of module unit, the trainee should be able to:
a) Use mathematical concepts and techniques in solving problems related to respective trade area
b) Organize, draw simple deductions and conclusions from the given data
c) Interpret graphical representation of functions relevant to the respective trade area

5.1.3   Module Unit Summary and Time Allocation

Mathematics I

Code	Sub-Module Unit	Content	Time (Hours)
5.1.01	Numbers	• Types of numbers • Operation on integers • GCD/HCF of a set of numbers • LCM of a set of numbers	4
5.1.02	Fractions and Decimals	• Types of fractions • Operations on fractions • Operations on decimals • Numbers in standard form • Rounding off numbers • Conversion of fractions to decimals and vice versa • Application of decimals and fractions knowledge to real life	8
5.1.03	Indices and Logarithms	• Base and index • Laws of indices • Application of laws of indices • Laws of logarithms • Application of laws of logarithms • Base change of a logarithm • Natural logarithms • Scientific calculator	8

Code	Sub-Module Unit	Content	Time (Hours)
5.1.04	Algebra	- Expression, equation and an identity - Simple equations - Manipulations of algebraic expressions - Factorisation of algebraic expressions - Transposition of formulae - Simultaneous equations with two unknowns - Quadratic equations	9
5.1.05	Sequence and Series	- Distinction between a sequence and a series - Solving of problems involving arithmetic and geometric progression - Calculating simple and compound interests	9
5.1.06	Mensuration	- Units of measurements - Perimeters and areas of regular figures - Volumes of regular solids - Surface areas of regular solids - Areas of irregular figures	9
5.1.07	Graphs	- Plotting linear graphs - Making interpretations from linear graphs - Solution of simultaneous equation and quadratic equations by plotting graphs - Presentation of data in appropriate charts	8
5.1.08	Elementary Statistics	- Definition of common terms in statistics - Frequency table - Calculation of central tendencies	3
5.2.09	Trigonometry	- Conversion of degrees to radians and vice versa - Trigonometric ratios and their reciprocals	8

Code	Sub-Module Unit	Content	Time (Hours)
		• Solution of right-angled triangles • Angles of elevation and depression • Determination of trigonometric ratios of angles greater than 900 • Solution of triangles • Proof of simple trigonometric identities using Pythagoras theorem • Compound angle formulae • Derivation of double angle formulae • Solution of simple trigonometric equations of the form • a sin x b cos x = c • Construction of sine and cosine waves	
Total			**66**

5.1.01 NUMBERS

5.1.01C Competence
The trainee should have the ability to apply the knowledge of G.C.D and L.C.M in real life situations

Theory

5.1.01T0 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to;
a) identify the various types of numbers
b) carry out arithmetic operations on integers
c) find the Greatest Common Divisor/Highest Common Factor (G.C.D/H.C.F) of a set of numbers
d) find the Least Common Multiple (L.C.M) of a set of numbers

Content
5.1.01T1 Types of numbers
5.1.01T2 Operation on integers
5.1.01T3 Greatest Common Division/Highest Common Factor G.C.D/H.C.F) of a set of numbers

5.1.01T4 Least Common Multiple (L.C.M) of a set of number lines

Suggested Teaching / Learning Activities
- Illustration
- Discussion
- Demonstration
- Taking notes
- Write numbers

Suggested Teaching / Learning Resources
- Chart illustrations
- Text books

Suggested Assessment Methods
- Written tests

5.1.02 FRACTIONS AND DECIMALS

5.1.02C Competence
The trainee should have the ability to:
a) Apply the knowledge of fractions and decimals in solving engineering problems
b) Perform operations on fractions and decimals

Theory

5.1.02T0   *Specific objectives*
            By the end of this sub-
            module unit, the trainee
            should be able to;
            a) identify various
                types of fractions
            b) perform operations
                on fractions in the
                correct order
            c) perform operations
                on decimals in the
                correct order
            d) express numbers in
                their standard form
            e) round off numbers
                to the required
                numbers of decimal
                places
            f)   convert fractions
                to decimals and vice
                versa
            g) solve problems
                related to fractions
                and decimals

            Content
5.1.02T1   Types of fractions
5.1.02T2   Operations on fractions
5.1.02T3   Operations on decimals
5.1.02T4   Numbers in standard
            form
5.1.02T5   Rounding off numbers
5.1.02T6   Conversion of fractions
            to decimals and vice
            versa
5.1.02T7   Application of decimals
            and fractions
            knowledge to real life

*Suggested Teaching/
Learning Activities*
-   Question and
    answer
-   Exercises

*Suggested Teaching /
Learning Resources*
-   Chart illustrations

*Suggested Assessment
Methods*
-   Written tests

**5.1.03   INDICES AND
            LOGARITHMS**

5.1.03 C   Competence
            The trainee should have
            the ability to solve
            mathematical problems
            related to indices and
            logarithms

Theory

5.1.03   *Specific Objectives*
            By the end of this sub-
            should be able to;
            a) define base and
                index
            b) state the laws of
                indices
            c) apply the laws of
                indices in
                calculations
            d) state the laws of
                logarithms
            e) apply the laws of
                logarithms in
                calculations
            f) change base of a
                logarithms

g) perform operations on natural logarithms

Content
5.1.03T1 Base and index
5.1.03T2 Laws of indices
5.1.03T3 Application of laws of indices
5.1.03T4 Laws of logarithms
5.1.03T5 Application of laws of logarithms
5.1.03T6 Base change of a logarithm
5.1.03T7 Natural logarithms

Suggested Teaching/Learning Activities
- Question and answer
- Taking notes
- Exercises

Suggested Teaching/Learning Resources
- Scientific calculator
- Text books
- Mathematical tables

Suggested Assessment Methods
- Written tests

5.1.04   ALGEBRA

5.1.04 C   Competence
The trainee should have the ability to form and solve practical problems involving

simultaneous and quadratic equations

Theory

5.1.04P0   *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to;
a) distinguish between an expression, equation and an identity
b) form and solve simple equations
c) perform operations on algebraic expressions
d) factorise algebraic expressions
e) transpose formulae to make new subject
f) form and solve simultaneous equations with two unknowns
g) form and solve quadratic equations

Content
5.1.04T1 Expression, equation and an identity
5.1.04T2 Simple equations
5.1.04T3 Manipulations of algebraic expressions
5.1.04T4 Factorisation of algebraic expressions
5.1.04T5 Transposition of formulae
5.1.04T6 Simultaneous equations with two unknowns
  i) elimination method

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ii) substitution method

5.1.04T7 Quadratic equation
i) factorization
ii) completing the square
iii) quadratic formula

Suggested Teaching / Learning Activities
- Question and answer
- Sketching
- Doing exercises

Suggested Teaching / Learning Resources
- Chart illustrations
- Text books

Suggested Assessment Method
- Written tests

5.1.05 SEQUENCE AND SERIES

5.1.05C Competence
The trainee should have the ability to apply the knowledge of sequence and series to solve building construction problems

Theory

5.1.05T0 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to:
a) distinguish between a sequence and a series

b) solve elementary problems involving arithmetic and geometric progression
c) apply knowledge of series in calculating simple and compound interests

Content

5.1.05T1 Distinction between a sequence and a series
5.1.05T2 Solving of problems involving arithmetic and geometric progression
5.1.05T3 Calculating simple and compound interests

Suggested Teaching/ Learning Activities
- Question and answer
- Exercises

Suggested Teaching/ Learning Activities
- Text books

Suggested Assessment Methods
- Written texts

5.1.06 MENSURATION

5.1.06C Competence
The trainee should have the ability to apply the knowledge of mensuration to solve building construction problems

Theory

5.1.04T0   *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to;
a) state different units of measurements
b) calculate perimeters and areas of regular figures
c) determine volumes of regular solids
d) determine surface areas of regular solids
e) determine areas of irregular figures

Content

5.1.06T1   Units of measurements
5.1.06T2   Perimeters and areas of regular figures
i) rectangle/squares
ii) triangle
iii) trapezium
iv) parallelogram/rhombus
v) sector
vi) segment
vii) annulus
5.1.06T3   Volumes of regular solids
5.1.06T4   Surface areas of regular solids
i) prisms
ii) cones
iii) pyramids
iv) frustums
v) spheres

5.1.06T5   Areas of irregular figures by the following methods
i) trapezoidal rule
ii) mid-ordinate rule
iii) Simpsons rule

Suggested Teaching/ Learning Activities
- Question and answer
- Sketching
- Doing exercises

Suggested Teaching / Learning Resources
- Chart illustrations

Suggested Assessment Methods
- Written tests

5.1.07   GRAPHS AND CHARTS

5.1.08 C   Competence
The trainee should have the ability to apply the knowledge of graphs to solve building construction problems

Theory

5.1.07T0   *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to;
a) plot linear graph
b) interpret linear graphs
c) solve simultaneous equation and quadratic equations

by the graphical method
d) present data in appropriate charts

Content
5.1.08T1 Plotting linear graphs
5.1.08T2 Making interpretations from linear graphs
  i) intercepts
  ii) gradients
5.1.08T3 Solution of simultaneous equation and quadratic equations by plotting graphs
5.1.08T4 Presentation of data in appropriate charts
  i) pie charts
  ii) bar charts
  iii) histograms
  iv) pictograms

Suggested Teaching / Learning Activities
- Question and answer
- Sketching
- Doing exercises

Suggested Teaching/ Learning Resources
- Chart illustrations
- Text books

Suggested Assessment Methods
- Written texts

5.1.08 **ELEMENTARY STATISTICS**

5.1.08C **Competence**
The trainee should have the ability to calculate the measures of the central tendencies

5.1.08 *Specific objectives*
By the end of this sub-module unit, the trainee should be able to;
a) define common terms in statistics
b) make a frequency table
c) calculate central tendencies

Content
5.1.08T1 Definition of common terms in statistics
  i) mean
  ii) mode
  iii) median
  iv) frequency
5.1.08T2 Frequency table
5.1.08T3 Calculation of central tendencies

Suggested Teaching / Learning Activities
- Discussion
- Illustration
- Lectures
- Practice

Suggested Teaching / Learning Resources
- Text books
- Audio visual
- Calculator

Suggested Assessment Methods
- Oral tests
- Written tests

5.1.09 TRIGONOMETRY

5.1.09C Competence
The trainee should have the ability to use the knowledge of trigonometry to solve engineering problems

5.1.09T0 *Specific objectives*
By the end of the sub-module unit, the trainee should be able to;
a) convert degrees to radians and vice versa
b) determine trigonometric ratios and their reciprocals
c) solve right-angled triangles
d) calculate angles of elevation and depression
e) determine trigonometric ratios of angles greater than 90^0
f) solve triangle by use of sine and cosine rules
g) prove simple trigonometric identities

h) determine the compound angle formulae
i) derive simple double angle formulae
j) solve simple trigonometric equations
iii) construct sine and cosine waves

Content
5.1.09T1 Conversion of degrees to radians and vice versa
5.1.09T2 Trigonometric ratios and their reciprocals
i) sine
ii) cosine
iii) tangent
iv) cosecant
v) secant
vi) cotangent
5.1.09T3 Solution of right-angled triangles by using;
i) pythagoras theorem
ii) trigonometric ratios
5.1.09T4 Angles of elevation and depression
5.1.09T5 Determination of trigonometric ratios of angles greater than 90^0
i) CAST rule
5.1.09T6 Solution of triangle
i) sine
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

ii) cosine rules
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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iii) $b^2 = a^2 + c^2 - 2ac \cos B$

iv) $c^2 = a^2 + b^2 - 2ab \cos C$

5.1.09T7 Proof of simple trigonometric identities using Pythagoras theorem
i) $\sin^2 x + \cos^2 x = 1$
ii) $1 + \tan^2 x = \sec^2 x$
iii) $1 + \cos^2 x = \cos^2 x$

5.1.09T8 Compound angle formulae
i) $\sin(A + B) = \sin A \pm \sin B \cos A$
ii) $\cos(A + B) = \cos A \pm \sin A \sin B$
iii) $\tan(A + B) = \tan A + \tan B$
iv) $1 - \tan A \tan B$
$1 + \tan A \tan B$

5.1.09T9 Derivation of double angle formulae
i) $\sin 2A = 2 \sin A \cos A$
ii) $\cos 2A = \cos^2 A - \sin^2 A$
$= 1 - 2 \sin^2 A$
$= 2 \cos^2 A - 1$
iii) $\tan 2A = 2 \tan A$
iv) $1 - \tan^2 A$

v) $1 + \tan 2A$

5.1.09T10 Solution of simple trigonometric equations of the form $a \sin x + b \cos x = c$

5.1.09T11 Construction of sine and cosine waves
i) $0^0 \leq x \leq 360^0$
ii) Amplitude
iii) Phase angle

Suggested Teaching / Learning Activities
- Questions and answers
- Lectures
- Assignments
- Doing exercises
- Graphs
- Plotting

Suggested Teaching / Learning Resources
- Charts
- Scientific calculator
- Mathematical sets
- Text books

Suggested Assessment Methods
- Written tests