18.2.0 MATHEMATICS II

18.2.1 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 the respective trade area.

18.2.2 General Objectives

By the end of the 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 a given data
c) interpret graphical representation of functions relevant to the respective trade area

18.2.3 Module Unit Summary and Time Allocation – (55 Hours)

MATHEMATICS II

Code	Sub-Module Units	Content	Total Hours
18 2.01	Complex Numbers	• Symbol j and its powers • Definition of a complex number • Operations on complex number • graphical representation (Argand) • Forms of representing complex numbers: Cartesian, polar and exponential • De Moivre's theorem and its application – roots of numbers and trigonometric identities • Apply complex numbers in engineering problems	12
18.2.02	Differential Calculus	• Gradient: straight line, curve at given point • Definition of differential coefficient • Differentiation from first principles • Differentiation of f(x)= axn • Higher derivatives • Differentiation of polynomials	15

		• Differentiation of trigonometric functions and other common function exponential, logarithmic • Methods of differentiation chain, product, quotient rules, parametric functions • Standard derivatives • Applications of differentiation to curve sketching, rates of change • Application of turning points • Partial differentiation of function in 2 variables • Applications of partial differential in small changes and stationery points, rates of change	
2.03	Hyperbolic Functions	• Definitions • Obsorn's rule • Identities • Equations of the form • ach x + bsh x = c	8
2.04	Intergral Calculus	• Reverse differentiation/indefinite integral • Integral of y = f(x) = axn • Definite standard integrals • Methods of integration: Substitution, partial fractions, parts • Reduction formula • Application of integration: area, volumes of solids of revolution, controids and centre mass	5
2.05	Ordinary Differential Equations (First and Second Order)	• Formation of Ordinary Differential Equations • Methods of solving first order Differential Equations by direct integration , separation of variables, linear, homogeneous • Application of ODE in simple harmonic motion and building • Second order differential equations with constant coefficients – the forms: • d2y + n2y = k • dx2	5

		• ad2y + bdy – cy = 0 • dx2 dx2 • ad2y + bdy + cy = f(x) • dx2 dx • Application of ordinary differential equations in simple harmonic motion, growth and decay	
18.2.06	D-Operator	• Theorems • Solution of differential equations	5
18.2.07	Power Series	• Taylor theorem and series • Maclauren theorem and series • Application of Taylor and Maclauren series	5
		Total	55

18.2.01 COMPLEX NUMBERS

Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) define a complex number
b) determine the power of j
c) perform arithmetic operations on complex numbers
d) represent complex numbers on the Argand diagram
e) express complex numbers in three forms
f) state and apply De Moivre's theorem
g) apply complex numbers in engineering

18.2.01C *Competence*

The trainee should have the ability to:

i) apply De Moivres theorem
ii) apply complex numbers in engineering
iii) perform arithmetic operations on complex numbers

Content

18.2.01T1	Definition of a complex number
18.2.01T2	Powers of j
18.2.01T3	Arithmetic operations on complex numbers
18.2.01T4	Graphical representation of complex (Argand diagram)
18.2.01T5	Forms of representing complex numbers - cartesian - polar - exponential
18.2.01T6	De Moivres theorem - roots of numbers - trigonometric identities
18.2.01T7	Application of complex numbers - resolution of forces - loci

18.2.02 DIFFERENTIAL CALCULUS

18.2.02 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define differentiation
b) differentiate from first principles
c) use standard derivatives in solving problems
d) state the rules of differentiation

e) apply the rules of differentiation to find derivatives of trigonometric, logarithmic and exponential function.
f) differentiate polynomials
g) find higher derivatives of functions
h) determine derivatives of implicit functions
i) find derivatives of parametric equations
j) apply differentiation
k) find partial derivatives
l) apply turning points
m) apply partial differentiation

Content

18.2.01 T1 Definition of differential
- coefficient

18.2.02 T2 Differentiation from first principles

18.2.03 T3 Standard derivatives

18.2.04 T4 Rules of differentiation
- product
- quotient
- chain rule

18.2.05T5 Differentiation of trigonometric, logarithmic and exponential functions

18.2.06 T6 Differentiation of polynomials

18.2.07T7 Higher derivatives

18.2.08 T8 Differentiation of implicit functions

18.2.09 T9 Differentiation of parametric equations, application of differentiation
- curve sketching
- rates of change
- small change
- turning points
- radius of curvature
- application of turning points

18.2.10 T10 Partial differentiation, two variables

18.2.11 T11 Application of partial differentiation
- small changes
- stationery points
- rates of change
- maxima, minima
- saddle points

18.2.03 HYPERBOLIC FUNCTIONS

18.2.03

Specific Objectives

By the end of the sub-module unit, the trainee should be able to:

a) define hyperbolic functions
b) evaluate hyperbolic functions for given arguments
c) state Osborne's rule
d) relate trigonometric identities to hyperbolic identities
e) solve equations of the form ach x + bshx = c

18.2.03C *Competence*
The trainee should have the ability to:
i) understand derivatives in solving problems
ii) apply rules of differential to find derivatives of trigonometric, logarithmetic and exponential

Content
18.2.01 T1 Definition of hyperbolic functions
18.2.02 T2 Evaluation of hyperbolic functions
18.2.03 T3 Osborne's rule
18.2.04 T4 Hyperbolic identities
18.2.05 T5 Solution of equations of the form ach x + bshx = c

18.2.03C **Competence**
The trainee should have the ability to:
i) evaluate hyperbolic functions for given arguments
ii) relate trigonometric identities to hyperbolic identities
iii) solve equations of the form ach x + bshx = c

18.2.04 INTEGRAL CALCULUS

18.2.04 *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
a) define integration
b) deduce integration by reverse differentiation
c) solve problems involving standard integrals
d) evaluate definite integrals
e) integrate functions using different methods
f) deduce reduction formulae
g) apply reduction formulae determine integrals
h) apply integration

18.2.04C *Competence*
The trainee should have the ability to:
i) reduce integration reverse differentiation
ii) evaluate definite integrals
iii) apply reduction formulae to determine integrals

Content
18.2.01 T1 Definition of integration
18.2.02 T2 Integration by reverse differentiation
18.2.03 T3 Standard integrals

18.2.04 T4 Definite integrals
18.2.05 T5 Methods of integration
- substitution
- partial fractions
- parts

18.2.06 T6 Reduction formulae deduction

18.2.07 T7 Determination of integrals using reduction formula

18.2.08 T8 Application of integration
- area
- volumes of solids of revolution
- centroids centre of mass

18.2.05 ORDINARY DIFFERENTIAL EQUATIONS (FIRST AND SECOND ORDER)

18.2.05 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) define a differential equation
b) form differential equations
c) solve first order differential equations of first degree
d) solve second order differential equations with constant coefficients
e) apply differential equations to practical situations

18.2.05C *Competence*

The trainee should have the ability to:

i) form a differential equation
ii) solve first order differential equations of first degree
iii) apply differential equations with coefficient

- *Content*

18.2.01 T1 Definition of a differential equation

18.2.02 T2 Formation of differential equations from practical situations, elimination of arbitrary constants

18.2.03T3 Solution of first order differential equations; direct integration, variable separation, linear equations, homogeneous equations

18.2.04 T4 Solution of second order differential equations of the forms

18.2.05 T5 Application of differential equations
- growth and decay
- simple harmonic motion (SHM)
- building

18.2.06 D-OPERATOR

18.2.06 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) state theorems of D-operator
b) solve differential equations using D-operator

18.2.06C *Competence*

The trainee should have the ability to:

i) state theorems of d-operator
ii) solve differential equations

Content

18.2.06T1 Theorems of D-operator
18.2.06T2 Solution of differential equations using D-operator

18.2.07 **POWER SERIES**

18.2.07 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

a) explain power series
b) state Taylor's theorem
c) use Taylor's theorem to obtain power series
d) deduce Maclaurin's theorem in numerical work

18.2.07C *Competence*

The trainee should have the ability to:

i) deduce maclaurin's theorem in numerical work
ii) use Taylor's theorem

Content

18.2.07T1 Power series explanation
18.2.07T2 Taylor's theorem
18.2.07T3 Taylor's series
18.2.07T4 Maclaurin's theorem

Suggested Teaching/Learning Methods

- Lecture
- Group work

Suggested Teaching/Learning Resources

- Charts
- Text books
- Calculator

Suggested Assessment Methods

- Written tests
- Assignment

Tools and Equipment

- Computer
- Calculator