7.1.0 ENGINEERING MATHEMATICS I

7.1.1 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 other analytical units of this course, and at the same time provide the trainee with a firm foundation for further training in the trade.

7.1.2 General Objectives

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

a) use mathematical concepts and techniques in solving problems related to Mechanical Engineering trade
b) organize, draw simple deductions and conclusions from the given data
c) interpret graphical representation of functions relevant to the Mechanical Engineering trade area.

7.1.3 Module Unit Summary and Time Allocation

MATHEMATICS I

Code	Sub module unit		Time
7.1.01	Fractions and Decimals	• Proper fractions and mixed numbers • Conversion of mixed and improper Fractions and vice versa • Application of the knowledge of decimals to engineering problems • Application of fraction to real life situations • Conversion of fractions into decimals and vice versa • Recurring decimals/fractions • Compare fractions	14
7.1.02	Indices and Logarithms	• Base and index • Laws of indices • Indicial equations ‘logarithm • Laws of logarithm • Logarithmic equations • Conversion of bases • Use of calculator	10

Code	Sub module unit		Time
7.1.03	Algebra	• Reduction of equations • Solution of equations reduced to quadratic form • Solutions of simultaneous linear equations in three unknowns • Solution of problems involving AP and GP	14
7.1.04	Trigonometry	• Half –angle formula • Factor formula • Trigonometric functions • Parametric equations	10
7.1.05	Permutations and Combinations	• Definition of permutation • Definition of combination • The factaral notation • Expressions involving permutations and combinations • Solution of problems involving permutations and combinations	12
7.1.06	Binomial Expansion	• Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem • Estimation of errors of small changes using binomial theorem	12
7.1.07	Coordinate Geometry	• Polar equations • Cartesian equation • Graphs of polar equations • Normals and tangents	12
7.1.08	Hyperbolic Functions	• Definition of hyperbolic equations • Properties of hyperbolic functions • Evaluation of hyperbolic functions • Hyperbolic identities • Osborne's Rule • ashx+bshx=C equation	18

Code	Sub module unit		Time
7.1.09	Inverse Functions	• One to-one relationship in functions • Inverse functions for one-to-one relationship • Inverse functions for trigonometric functions • Graph of inverse functions • Inverse hyperbolic functions	18
7.1.10	Complex numbers	• Definition of complex numbers • Stating complex numbers in terms of conjugate argument and • modulus • Representation of complex numbers on the Argand diagram • Arithmetic operation of complex numbers • Application of Demoivre's theorem • Application of complex numbers to engineering	12
Total Time			**132**

7.1.01 FRACTIONS AND DECIMALS

7.1.01T0 *Specific Objectives*

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

a) identify proper, improper and mixed fractions
b) convert mixed numbers to improper fractions and vice versa
c) compare fractions
d) apply the knowledge of fractions to real life situations
e) convert fractions into decimals and vice versa
f) identify recurring decimals
g) convert recurring decimals into fractions
h) apply the knowledge of decimals to engineering problems

7.1.01C *Competence*

The trainee should have the ability to:

i) perform the basic operations on fraction and decimals
ii) apply the knowledge of fractions and decimals in engineering

Content

7.1.01T1	Proper fractions and mixed numbers
7.1.01T2	Conversion of mixed and improper fractions and vice versa
7.1.01T3	Compare fractions
7.1.01T4	Application of fraction to real life situations
7.1.01T5	Conversion of fractions into decimals and vice versa
7.1.01T 6	Recurring decimals
7.1.01T 7	Conversion of recurring decimals into fractions
7.1.01T 8	Application of the knowledge of decimals to engineering problems

Suggested Learning Resources

- Chart illustration on fractions equivalent fraction
- Real life situations

7.1.02 INDICES AND LOGARITHMS

7.1.02T1 *Specific Objectives*

By the end of the sub module unit, the

trainee should be able to:

a) define the terms base and index
b) state the laws of indices
c) perform simple operations of indices
d) define the term logarithm
e) state laws of logarithms
f) perform simple operations of logarithms
g) change the bases of logarithms
h) Use calculator in solving problems related to logarithms

7.1.02C *Competence*
The trainee should have the ability to work out mathematical problems related to indices and logarithms

Content

7.1.02T 1 Base and index
7.1.02T 2 Laws of indices
7.1.02T 3 Simple operations on indices
7.1.02T 4 Indicial equations ‘logarithm
7.1.02T 5 Laws of logarithm
7.1.02T 6 Logarithmic equations
7.1.02T 7 Conversion of bases
7.1.02T 8 Use of calculator in solving problems related to logarithms

Suggested Learning Resources
- Calculates
- Charts
- Audio visual media

7.1.03 ALGEBRA

7.1.03T1 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
reduce logarithmic equations to quadratic equations

a) solve equations reduced to quadratic forms
b) solve linear simultaneous equations with three unknowns
c) solve problems involving arithmetic progression and geometric progression

d)

7.1.03C *Competence*
The trainee should have the ability to solve problems involving arithmetic progression and geometric progression

Content

7.1.03T1 Reduction of equations

7.1.03T2 Solution of equations reduced to quadratic form

7.1.03T3 Solutions of simultaneous linear equations in three unknowns

7.1.03T4 Solution of problems involving AP and GP

Suggested Learning Resources

- Print media
- Audio media
- Real live experience

7.1.04T0 TRIGONOMETRY

7.1.04T0 *Specific Objectives*

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

a) Derive the half-angle
b) Derive the factor formula
c) Solve trigonometric functions
d) Determine parametric equations

7.1.04C *Competence*

The trainee should have the ability to solve problems in trigonometry

Content

7.1.04T1 Half –angle formula

7.1.04T2 Factor formula

7.1.04T3 Trigonometric functions

7.1.04T4 Parametric equations

Suggested Learning Resources

- Charts
- Mathematical tables
- Calculators
- Light-angled triangles
- Real life experience

7.1.05 PERMUTATIONS AND COMBINATIONS

7.1.05T0 *Specific Objectives*

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

a) define the term permutation
b) define the term combination
c) express numbers in factorial notation
d) simplify expressions involving permutations and combinations
e) solve problems involving permutation and combination.

7.1.05C *Competence*

The trainee should have the ability to solve problems in

permutations and combinations

Content

7.1.05T1 Definition of permutation

7.1.05T2 Definition of combination

7.1.05T3 The factorial notation

7.1.05T4 Expressions involving permutations and combinations

7.1.05T5 Solution of problems involving permutations and combinations

Suggested Learning Resources

- Charts
- Real life situations

7.1.06 BINOMIAL EXPANSION

7.1.06T0 *Specific Objectives*

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

a) state the binomial theorem
b) apply the binomial theorem in deriving power series of simple functions
c) apply binomial theorem to estimate errors of small changes
d) apply binomial theorem to estimate roots of numbers
e)

7.1.06C *Competence*

The trainee should have the ability to apply binomial theorem to estimating errors

Content

7.1.06T1 Binomial theorem

7.1.06T2 Power series using binomial theorem

7.1.06T3 Roots of numbers using binomial theorem

7.1.06T4 Estimation of errors of small changes using binomial theorem

Suggested Learning Resources

- Charts

7.1.07 COORDINATE GEOMETRY

7.1.07T0 *Specific Objectives*

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

a) convert polar equations to cartesian equation
b) convert cartesian equation to polar equations
c) plot graphs of polar equations
d) determine normals and tangents using co-ordinate geometry

7.1.07C *Competence*
The trainee should have the ability to work out problems in coordinat geometry

Content

7.1.07T1 Polar equations
7.1.07T2 Cartesian equation
7.1.07T3 Graphs of polar equations
7.1.07T4 Normals and tangents

Suggested Learning Resources

- Charts
- Squared grid-board
- Calculators

7.1.08 HYPERBOLIC FUNCTIONS

7.1.08T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

a) define hyperbolic functions
b) deduce properties of hyperbolic functions
c) evaluate hyperbolic functions for given arguments
d) verify simple hyperbolic relationships of identities
e) sate the osborne's rule
f) solve equations of the form aChx+bShx= c

7.1.08C *Competence*
The trainee should have the ability to work out problems in hyperbolic functions

Content

7.1.08T1 Definition of hyperbolic equations
7.1.08T2 Properties of hyperbolic functions
7.1.08T3 Evaluation of hyperbolic functions
7.1.08T4 Hyperbolic identities
7.1.08T5 Osborne's Rule
7.1.08T6 aChx+bshx=c equation

Suggested Learning Resources

- Tables
- Calculators

7.1.09 INVERSE FUNCTIONS

7.1.09T1 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

a) identify one-to-one relation in functions
b) define inverse function for trigonometric functions

c) draws graphs of inverse functions
d) describe many valued nature of functions
e) describe the principal of inverse trigonometric function
f) derive the inverse hyperbolic function

7.1.08C *Competence*
The trainee should have the ability to work out problems in inverse functions

Content

7.1.09T1 One to-one relationship in functions

7.1.09T2 Inverse functions for one-to-one relationship

7.1.09T3 Graph of inverse functions

7.1.09T4 Many valued nature of functions

7.1.09T5 Principle of inverse trigonometric function

7.1.09T5 Inverse hyperbolic functions

Suggested Learning Resources
- Tables
- Calculators

7.1.10 COMPLEX NUMBERS

7.1.10T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) define a complex number
b) state complex numbers in three forms
c) segment complex numbers on the argand diagram
d) perform arithmetic operation on complex numbers
e) state and apply the de moivre's theorem
f) apply complex numbers to engineering problems

7.1.10C *Competence*
The trainee should have the ability to:
i) Demonstrations
ii) Questions and answers
iii) Discussions

Content

7.1.10T1 Definition of complex numbers

7.1.10T2 Stating complex numbers in terms of conjugate argument and modulus

7.1.10T3 Representation of complex numbers on the Argand diagram

7.1.10T4 Arithmetic operation of complex numbers

7.1.10T5	Application of De Moivre's theorem	*Suggested Learning Resources* - Charts - Calculators
7.1.10T6	Application of complex numbers to engineering problems	