12.2.0   MATHEMATICS II

12.2.1   Introduction
This module unit is intended to equip the trainee with knowledge, skills and attitudes to enable him/her operate effectively in an organization.

12.2.2   General Objectives
By the end the end of the module unit, the trainee should be able to;
  a) appreciate the role of mathematics in mechanical engineering
  b) understand different ratios and proportions
  c) appreciate the role of technology in mechanical engineering
  d) appreciate the impact of emerging issues in mechanical engineering

12.2.3   Module Unit Summary and Time Allocation

	Sub-Module Units	Content	Time (Hrs)
12.2.01	Probability	• Definition of probability • Deducing events	6
12.2.02	Statistics	• Definition of statistics • Measure of central tendency • Measure of dispersion	6
12.2.03	Commercial Arithmetic	• Currencies of different countries • Currency conversion • Profit and loss • Profit and loss as percentage • Simple and compound interest	6
12.2.04	Trigonometry	• Pythagoras theorem • Application of pythagoras theorem to real life situations • Definition of trigonometric ratios • Tables and calculators in trigonometric ratios • Angle of elevation and depression • Sine and cosine rules	11

	Sub-Module Units	Content	Time (Hrs)
		• Derivation of angle formulae • Trigonometric equations • Sine and cosine waveform	
12.2.05	Matrices	• Definition of a matrix • Operation on matrices • Determinant of a matrix • Inverse of a matrix • Solution of simultaneous equations by matrix method	6
12.2.06	Vectors	• Definition of a vector and scalar quantity • Vector notation • Vectors on a grid • Operations on vectors • Relative velocity	11
12.2.07	Introduction to Calculus	• Definition of derivative of a function • Differentiation of various functions from first principles • Tables of some common derivatives • Rules of differentiation • Higher order of derivatives • Application of differentiation • Definition of partial functions of two variables • Partial differentiation of functions of two variables • Solution of partial differentiation to small changes • Stationary points for functions of two variables	8
12.2.08	Integral Calculus	• Integration • Indefinite and definite integrals • Solution of problems of integration • Application of problems of integration to real life	12
Total Time			**66**

12.2.01 PROBABILITY

12.2.01T *Specific objectives*
By the end of the sub-module unit, the trainee should be able to;
a) define the terms probability
b) deduce events

Content
12.2.01T1 Definition of probability
12.2.01T2 Deducing events
  i) dependent
  ii) independent
  iii) mutually exclusive

12.2.02 STATISTICS

12.2.02T *Specific objectives*
By the end of the sub module unit, the trainee should be able to;
a) define the term statistics
b) determine measures of central tendency
c) determine measures of dispersion

Content
12.2.02T1 Definition of statistics
12.2.02T2 Measures of central tendency
12.2.02T3 Measures of dispersion

12.2.03 COMMERCIAL ARITHMETIC

12.2.03T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) state the currencies of different countries
b) convert currency from one form to another given the exchange rates
c) calculate profit and loss
d) express profit and loss as percentages
e) calculate simple and compound interest

Content
12.2.03T1 Currencies of different countries
12.2.03T2 Currency conversions
12.2.03T3 Profit and loss
12.2.03T4 Profit and loss as percentage
12.2.03T5 Simple and compound interest

12.2.04 TRIGONOMETRY

12.2.04T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) solve simple problems using Pythagoras theorem

b) apply pythagoras theorem to real life situations
c) define trigonometric ratios
d) use tables and calculators in trigonometric ratios to convert degrees to radians and vice versa
e) determine angles of elevation and depression
f) solve problems in triangles using sine and cosine rules
g) derive angle formulae
h) solve trigonometric equations
i) draw sine and cosine waveforms

Content
12.2.04T1 Pythagoras theorem
12.2.04T2 Application of Pythagoras theorem to real life situations
12.2.04T3 Definition of trigonometric ratios
    i) sine ө
    ii) cosine ө
    iii) tangent ө
12.2.04T4 Tables and calculators in trigonometric ratios
    i) sine tables
    ii) cosine tables
    iii) tangent tables

12.2.04T5 Angles of elevation and depression
12.2.04T6 Solution of problem in triangles using sine and cosine rules
12.2.04T7 Derivation of double angle formulae
    i) double angle
    ii) compound angle
12.2.04T8 Trigonometric equations
12.2.04T9 Sine and cosine waveforms

12.2.05 MATRICES

12.2.05T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) define a matrix
b) carry out operations on matrices
c) work out the determinant of a matrix
d) work out the inverse of a 2 x 2 matrix
e) apply matrices in solving simultaneous equations

Content
12.2.05T1 Definition of a matrix
12.2.05T2 Operation on matrices
12.2.05T3 Determinant of a 2 x 2 matrix
12.2.05T4 Inverse of a matrix
12.2.05T5 Solution of simultaneous equations by matrix method

12.2.06   VECTORS

12.2.06T   *Specific Objectives*
By the end of the sub-module, the trainee should be able to;
  a) define a vector and a scalar quantity
  b) use vector notation
  c) present vectors on a grid
  d) carryout operations on vectors
  e) determine relative velocity

Content
12.2.06T1 Definition of a vector and a scalar quantity
12.2.06T2 Vector notation
12.2.06T3 Vectors on a grid
12.2.06T4 Operation on vectors
      i)   addition
      ii)   multiplication
      iii) resolution
12.2.06T5 Relative velocity

12.2.07   INTRODUCTION TO CALCULUS

12.2.07T   *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
  a) define the derivative of a function
  b) differentiate various functions from first principles
  c) refer to tables of derivatives of some common functions
  d) Apply the rules of differentiation
  e) determine the derivative of higher order
  f) define partial functions for two variables
  g) differentiate partial functions of two variables
  h) solve problems involving small changes using partial fractions
  i) find stationary points for functions of two variables

Content
12.2.07T1 Definition of derivative of a function
12.2.07T2 Differentiation of various functions from first principles
      i)   linear
      ii)   polynomial
      iii) trigonometric
12.2.07T3 Table of some common derivatives
12.2.07T4 Rules of differentiation
      i)   sum
      ii)   product rule
      iii) quotient rule
      iv)   chain rule
12.2.07T5 Higher order derivatives

135

12.2.07T6	Application of differentiation
	i) stationery points
	ii) curve
	iii) Sketching
	iv) rates of change
	v) small errors
12.2.07T7	Definition of partial functions of two variables
12.2.07T8	Partial differentiation of functions of two variables
12.2.07T9	Solution of partial differentiation to small changes
12.2.07T10	Stationary points for functions of two variables

12.2.08   INTEGRAL CALCULUS

12.2.08T   *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
a) define integration
b) differentiate between indefinite and definite integrals
c) solve problems involving various methods of integration
d) apply integration to real life situations

Content

12.2.08T1	Integration
12.2.08T2	Indefinite and definite integrals
12.2.08T3	Solutions to problems of integration including
	i) integration by substitution
	ii) integration by partial fractions
	iii) integration by t-tan½ɵ substitution
	iv) integration by sin ɵ and cos ɵ substitution
	v) integration by parts
12.2.8T4	Application of integration to real life
	i) velocity, acceleration
	ii) area under a curve

Suggested Teaching/Learning Resources
- Plait and audio/visual material
- Charts
- Mathematical tables
- Scientific calculators
- Square grid-boards
- Normal tables
- T-distribution tables
- Tables of integrals

- Computers
- Tables of LT
- Regular solids

Suggested Assessment Methods
- Written tests

- Puzzles and games
- Quizzes
- Oral tests
- Assignment