25.3.0 MATHEMATICS III

25.3.01 Introduction

This module unit is designed with knowledge, skills, techniques and attitudes necessary to enhance the trainee's understanding of other analytical areas of study in this course. The module unit will also be very useful to trainees who aspire to further their training in this course.

This module is a build up of Mathematics I and II of this course. Trainees undertaking this module unit require to have successfully completed Mathematics I and II of this course or its equivalent.

Timed tests, assignment, end of Module examinations are the recommended mode of evaluation for this Module unit, and any other suitable method.

25.3.02 General Objectives

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

a) apply mathematics concepts in fabrication design and data analysis
b) organize, draw simple deductions and conclusions from the given data
c) apply probability and mensurations in vehicle and vehicle parts fabrication works

25.3.03 Module Unit Summary and Time Allocation

Mathematics III

Code	Sub Module Unit	Content	Time
25.3.1	Vector Field Theory	• Definition of dot and cross products of vectors • Solution of problems involving dot and cross products of vectors • Definition of operators • Definition of vector field • Definition of curl F • Solutions of problems involving curl F • Solutions of problems involving F	12
25.3.2	Matrices	• Matrix operation	10

		• Determinant of 3x3 matrix • Inverse of 3x3 matrix • Solution of linear simultaneous equations in 3 unknowns • Application of matrices	
25.3.3	Numerical Methods	• Definition of interpolation and extrapolation • Application of interpolation and • Application of interactive methods to solve equations • Application of interactive methods to areas and volumes	8
25.3.4	Double And Triple Integrals	• Definition of double and triple integrals • Use of multiple integrals to find areas and volume • Consideration of double integrals in polar and cylindrical coordinates • Use of triple integrals in solving problems	8
25.3.5	Differential Equations	• Types of first order differential equations • Formation of first order differential equations • Solutions of first order differential equations • Application of first order 8differential equations Formation of the second order differential equations for various systems • Solution of second order differential equations ' • Application of second order differential equations	10
25.3.6	Laplace Transforms	• Definition of Laplace transforms Deriving Laplace transforms from first principles • State properties of Laplace transform • Determination of inverse LT of simple transforms and partial fractions	8

		• Solution of differential equations by LT • Solution of simultaneous differential equations by given initial conditions	
25.3.7	Fourier series	• Determination of the fourier series as a periodic function of period 2 Π and extended to Π • Determination of fourier series of non-perodic functions over a given range • Determination of fourier series for even and odd functions and the half-range series for a given function	6
25.3.8	Loci	• Definition of a point • Locus of a point in relation to a circle • Loci of points for given mechanism	4
Total Time			**66**

25.3.1 VECTOR FIELD THEORY

25.3.1T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define dot and gross products of vectors
b) solve problems involving dot and cross products of vectors
c) define operators
d) define vector field f
e) define curl f
f) define div f
g) solve problems involving curl f
h) solve problems involving div f

Content
25.3.1T1 Definition of dot and cross products of vectors
25.3.1T2 Solution of problems involving dot and cross products of vectors
25.3.1T3 Definition of operators
25.3.1T4 Definition of vector field (F)
25.3.1T5 Definition of curl (F)
25.3.1T6 Definition of div (F)
25.3.1T7 Solutions of problems involving curl (F)
25.3.1T8 Solutions of problems involving (F)

25.3.2 MATRICES

25.3.2T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) carry out matrix operations
b) determine the determinant of a 3x3 matrix
c) determine the inverse of a 3x3 matrix
d) solve linear simultaneous equations in 3 unknowns
e) apply knowledge of matrices in solving problems in real life

Content
25.3.2T1 Matrix operation
25.3.2T2 Determinant of 3x3 matrix
25.3.2T3 Inverse of 3x3 matrix
25.3.2T4 Solution of linear simultaneous equations in 3 unknowns
25.3.2T5 Application of matrices

Suggested Learning Resources
i) Charts
ii) Square boards

25.3.3 NUMERICAL METHODS

25.3.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define interpolation and extrapolation
b) apply interpolation

extrapolation
c) apply interactive methods to solve problems
d) apply interactive methods to areas and volumes

25.3.3C *Competence*
The trainee should have the ability to apply knowledge of integrals to engineering

Content

25.3.3T1 Definition of interpolation and extrapolation
25.3.3T2 Application of interpolation and extrapolation
25.3.3T3 Application of interactive methods to solve equations
25.3.3T4 Application of interactive methods to areas and volumes

Suggested Learning Resources
i) Graphs
ii) Calculators

25.3.3 DOUBLE AND TRIPLE INTEGRALS

25.3.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define double and triple integrals
b) use multiple integrals to find areas and volume
c) consider double integrals in polar and cylindrical coordinates
d) use triple integrals in solving problems

Content

25.3.3T1 Definition of double and triple integrals
25.3.3T2 Use of multiple integrals to find areas and volume
25.3.3T3 Consideration of double integrals in polar and cylindrical coordinates
25.3.3T4 Use of triple integrals in solving problems

Suggested Learning Resources
- Calculators

25.3.4 DIFFERENTIAL EQUATIONS

25.3.4T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) distinguish different types of first order differential equations
b) form first order differential equation
c) solve first order differential equations
d) apply first order differential

equations
e) form the second order differential equations
f) solve second order differential equations
g) apply second order differential equations in different systems

25.3.4C *Competence*
The trainee should have the ability to apply knowledge of differential equations to engineering

Content
25.3.4T1 Types of first order differential equations
25.3.4T2 Formation of first order differential equations
25.3.4T3 Solutions of first order differential equations
25.3.4T4 Application of first order differential equations
25.3.4T5 Formation of the second order differential equations for various systems
25.3.4T6 Solution of second order differential equations '
25.3.4T7 Application of second order differential equations

Suggested Learning Resources
i) Calculators

25.3.5 LAPLACE TRANSFORMS

25.3.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define the Laplace transforms
b) derive the transforms of simple functions
c) state the properties of Laplace transforms
d) determine the inverse of LT of simple forms and partial fractions
e) solve differential equation by LT
f) solve simultaneous differential equations by LT given initial conditions

25.3.5C Competence
The trainee should have the ability to apply Laplace transforms to engineering.

Content
25.3.5T1 Definition of Laplace transforms
25.3.5T2 Deriving Laplace transforms from first principles
25.3.5T3 State properties of Laplace transform
25.3.5T4 Determination of inverse LT of simple transforms and partial fractions
25.3.5T5 Solution of differential

equations by LT

25.3.5T6 Solution of simultaneous differential equations by given initial conditions

Suggested Learning Resources
Laplace tables

25.3.6 FOURIER SERIES Π

25.3.6T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) determine the Fourier series of a periodic function of period 2 Π and extended to Π
b) determine the Fourier series for a non-periodic function of the range of 2 Π to Π
c) determine Fourier series for even and odd functions and half-range series for a given function

Content

25.3.6T1 Determination of the Fourier series as a periodic functions of period 2 Π and extended to Π

25.3.6T2 Determination of Fourier series of non-periodic functions over a given range

25.3.6T3 Determination of Fourier series for even and odd functions and the half-range series for a given function

Competence
The trainee should have the ability to apply Fourier series to engineering.

Suggested Learning Resources
Graphs

25.3.7 LOCI

25.3.7T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define the locus of a point
b) determine the locus of a point in relation to a circle
c) calculate loci of parts for given mechanisms

25.3.7C Competence
The trainee should have the ability to apply loci to engineering.

Content

25.3.7T1 Definition of a point

25.3.7T2 Locus of a point in relation to a circle

25.3.7T3 Loci of points for given mechanism

Suggested Learning Resources
i) Charts

ii) Scientific calculators