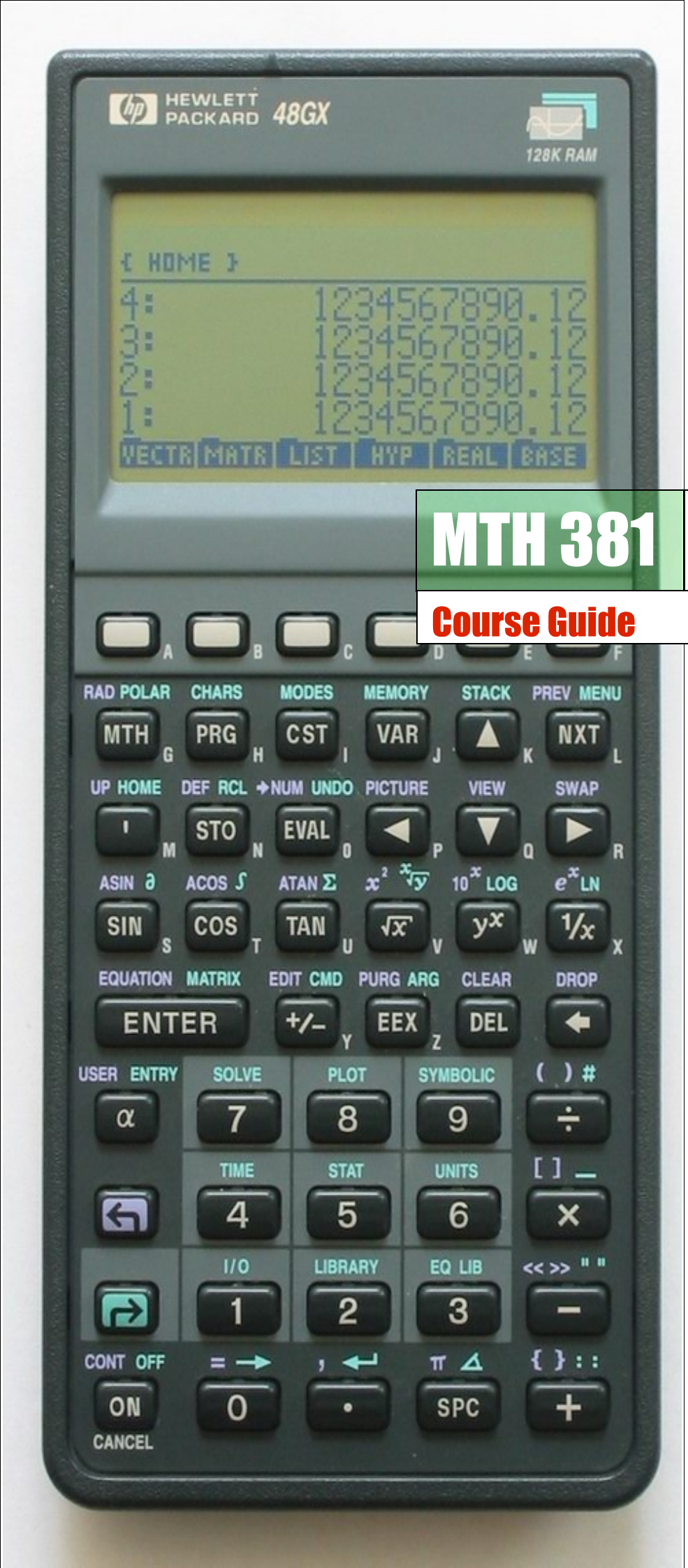

MTH 381

MATHEMATICAL METHOD III

Course Guide

COURSE GUIDE

MTH 381
MATHEMATICAL METHOD III

Course Developer/Writer — S.O. AJIBOLA
School of Science & Technology
National Open University of Nigeria
Victoria Island, Lagos

Programme Leader — Dr. Sunday Reju
RETRIDAL
National Open University of Nigeria
Victoria Island, Lagos

Course Co-ordinators — Bankole Abiola and S.O. Ajibola
School of Science & Technology
National Open University of Nigeria
Victoria Island, Lagos

NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria
Headquarters
14/16 Ahmadu Bello Way
Victoria Island
Lagos

Abuja office
No. 5 Dar es Salaam Street,
Off Aminu Kano Crescent
Wuse II, Abuja
Nigeria

e-mail: centralinfo@nou.edu.ng
URL: www.nou.edu.ng

Published by:
National Open University of Nigeria 2008

First Printed 2008

ISBN: 978-058-377-7

CONTENTS **PAGES**

Introduction

The course – mathematical method- is meant to provide essential methods for solving mathematical problems.

In scientific problems, often times are discovers that a factor depends upon several other related factors. For instance, the area of solid depends on its length and breadth. Potential energy of a body depends on gravity, density and height of the body e.t.c. Moreover, the strength of a material depends on temperature, density, isotropy and softness e.t.c.

What You will Learn in this Course

This is a 3units course, it is grouped into four (4) modules i.e. module1, 2, 3 and 4. Module 1 has 2units; module 2 also has 2unitsas well as module 3 with only one unit while module 4 has 3units. In summary four (4) modules and 8 units in all.

The course guide gives a brief summary of the total contents contained in the course material. Functions of several variables streamline the relationship between function and variables, the application of Jacobian, down to functional dependence and independence. Also discussed here in the multiple, line and improper integrals.

Course Objectives

- to be able to identify functions of two or more variables;
- the ideal of Jacibian to bee extended to three variables;
- the use of Jacibian to change variables in multiple integral; and
- to determine whether two or more functions are linearly depended or independent respectively.

Working through the Course

This course involves that you would be required to spend lot of time to read. The content of this material is very dense and require you spending great time to study it. This accounts for the great effort put into its development in the attempt to make it very readable and comprehensible. Nevertheless, the effort required of you is still tremendous.

I would advice that you avail yourself the opportunity of attending the tutorial sessions where you would have the opportunity of comparing knowledge with your peers.

Course Materials

You will be provided with the following materials:

- Course guide
- Study units

In addition, the course comes with a list of recommended textbooks, which though are not compulsory for you to acquire or indeed read, are necessary as supplements to the course material.

Study Units

The following are the study units contained in this course. The units are arranged into four identifiable but related modules.

Module 1 Functions of Several Variables

Unit 1 Some Basic Concepts

This unit takes you through the definition of functions of several variable, Jacibian, functional dependence and independence, multiple integral, line integrals and improper integrals.

Unit 2 Vector Field Theory

The second unit of this module deals with the relation between vector field and functions.

Integral theorems: Gauss's stokes and Green's theorems are also discussed.

Module 2

Unit 1 Functions of Complex Variables

In this unit Complex Numbers is discussed, and further streamlined into, Representation ≈ the form $z = x + iy$. Complex plane, arithmetic operations, properties of the arithmetic operations, complex conjugate numbers.

However, polar forms of complex numbers are also discussed and stream-lined as follows:

- Multiplication and Division – Polar form.
- Roots

- Curves and regions = the complex plane and some concepts related to sets in the complex plane.

Limit and Derivative (Analytic Function). Streamlines to:

- Complex Function
- Limit Continuity
- Derivative
- Analytic Functions

Cauchy – Rieman Equations streamlines into: two theorems

- Laplace's Equation and
- Harmonic Functions.

Lastly, Exponential functions and Trigonometric functions:

- Hyperbolic functions

Unit 2 Integration of Complex Plane

In this unit, we discussed: line integral – complex plane: Definition of complex line integral, Existence of the complex line integral, and the three Basic properties of complex line integral.

Two integration methods were further discussed thus: use of a representation of the path, indefinite integral and Bound for the Absolute value of integrals.

Cauchy's integral Theorem: Features:

Cauchy's integral, independence of path deformation of path, Cauchy's theorem for multiple connected Domain.

Also discussed – this unit are

- Existence of indefinite integral
- Cauchy's integral formula
- Derivative of Analytic functions
- Morera's theorem and
- Liouville's theorem.

Module 3

Unit 1 Residue Integration Method

This unit features:

Residues: streamlines into

- Two formulae for Residues at simple poles,
- Formulae for Residues at a pole of any order
  Residue Theorems,

Evaluation of real integrals: improper integrals of Rational functions.

Further types of read integrals: Fourier integrals other types of Read improper integrals and theorem on simple poles on the real axis.

Module 4

Unit 1 Integral Transform

This unit features:

- Finite Fourier Transforms: Half range Fourier cosine and sine series, ordinary fourier series
- The Fourier Transform: Fourier sine and cosine transform, ordinary Fourier transform.
- Transform of Derivatives.

Unit 2 Fourier Series and Its Application

This unit entails:

1. **FOURIER SERIES:** Euler formulars for the Fourier coefficients.
2. Even and Odd functions: Fourier series of even and odd functions and sum of functions are discussed in details.

Unit 3 The Laplace Transform

This unit talked on

- The classical Laplace Transform: the introduction, elementary applications of the Laplace transform, Application of Laplace to solution of ordinary differential equations also application of Convolution Theorem.

- Laplace transform of generalized functions.
- Computation of Laplace transforms.

Textbook and References

The following editions of these books are recommended for further reading.

Advance Engineering Mathematics by KREYSZIC.

Generalized Functions by R. F. Hoskins.

Complex Variables by Murray R. Spiegel.

Engineering Mathematics by K. A. Stroud.

Advance Calculus for Applications by F. B. HILDRABAND.

Assessment

There are two components of assessment for this course. The Tutor Marked Assignment (TMA), and the end of course examination.

Tutor-Marked Assignment

The (TMA) is the continuous assessment component of your course. It accounts for 30% of the total score. You will be given four (4) TMAS' to answer. Three of these must be answered before you are allowed to sit for the end of course examination. The TMAS' would be given to you by your facilitate and returned after you have done the assignment.

Final Examinations and Grading

This examination concludes the assessment for the course. It constitutes 70% of the whole course. You will be informed of the time the examination. It may or may not coincide with the University Semester Examination.

Summary

The Students have been taught how to use Jacobian method to change the Variable – multiple integral, also to determine whether two functions are linearly dependent or independent.

Solve line, multiple and improper integrals.

The use of Fourier transform to solve some differential Equation, Boundary values problems and e.t.c. Also talked about is Laplace transformation to solve some initial and Boundary value problem, which are difficult to handle. After which Convolution theory is applied. And the result's then retrans-formed back to physical or mechanical problems.

So far about three methods have been thoroughly dealt with in this course. In Mathematical methods IV. We shall still talk about several other methods to handle any category of problem, provided the problem can be modeled into Mathematical problems.