

TEACHING AND LEARNING SERIES : FACULTY OF ELECTRICAL ENGINEERING

SOLUTION MANUAL OF ENGINEERING MATHEMATICS

Module 5

TAY CHOO CHUAN • HAMZAH SAKIDIN • RAHIFA RANOM
MOHD RIZUAN BAHARON • IRMA WANI JAMALUDIN

TEACHING AND LEARNING SERIES : FACULTY OF ELECTRICAL ENGINEERING

SOLUTION MANUAL OF ENGINEERING MATHEMATICS

Module 5

**Tay Choo Chuan • Hamzah Sakidin • Rahifa Ranom
Mohd Rizuan Baharon • Irma Wani Jamaludin**

Penerbit Universiti
Universiti Teknikal Malaysia Melaka

© FIRST PUBLISHED 2008
Universiti Teknikal Malaysia Melaka

ISBN: 978-983-2948-32-2

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, electronic, mechanical photocopying, recording or otherwise, without the prior permission of the Publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Solution manual of engineering mathematics. Module 5 / Tay Choo

Chuan ... [et al.].

(Teaching and learning series : faculty of electrical engineering)

Bibliography: p.81

ISBN 978-983-2948-32-2

1. Engineering mathematics--Study and teaching (Higher). I. Tay,
Choo Chuan. II. Siri.

510.2462076

Published in Malaysia by:

Penerbit Universiti
Universiti Teknikal Malaysia Melaka
Hang Tuah Jaya, Ayer Keroh, 75450 Melaka

Printed in Malaysia by

NGD ENTERPRISE
790-D, Kampung Lapan, Taman Sri Bacang,
75300 Melaka.

TABLE OF CONTENT

| | Page |
|---|-------------|
| Preface | v |
| Chapter I Function of Several Variables | 3 |
| Tutorial 1 | 4 |
| Tutorial 2 | 9 |
| Tutorial 3 | 11 |
| Tutorial 4 | 14 |
| Tutorial 5 | 20 |
| | |
| Chapter II Multiple Integral | 27 |
| Tutorial 6 | 28 |
| Tutorial 7 | 34 |
| Tutorial 8 | 42 |
| Tutorial 9 | 49 |
| Tutorial 10 | 54 |
| | |
| Chapter III Vector | 63 |
| Tutorial 11 | 64 |
| Tutorial 12 | 72 |
| | |
| Appendices | 79 |
| | |
| References | 81 |

Preface

One of the most challenging aspects of mathematics learning is to give students suitable examples and exercises which can improve their understanding.

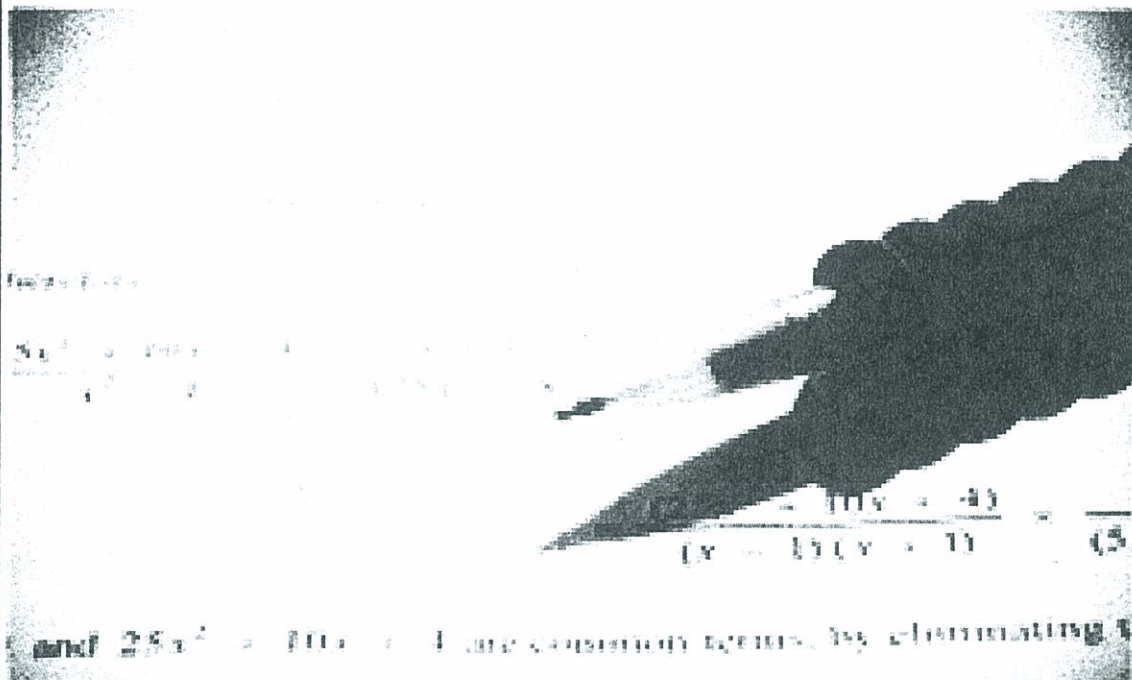
This solution manual of Engineering Mathematics is designed to serve as a study guide for engineering students of Universiti Teknikal Malaysia Melaka (UTeM). The topics are based on the syllabus of Engineering Mathematics teaching in UTeM.

The material in this book will cover questions and answers for:

- ❖ Function of Several Variables
- ❖ Multiple Integral
- ❖ Vector

An excellent student must have an initiative to learn before being taught by lecturers. By using this manual, students can be more prepared before attending a tutorial session. The examples are presented in a sequence of steps with full details so that students can follow systematically.

In preparing this manual, we would like to thank all the individuals involved. Such comments and feedback are always welcome.



CHAPTER ONE

FUNCTION OF SEVERAL VARIABLES

CHAPTER ONE

FUNCTION OF SEVERAL VARIABLES

After completing these tutorials, students should be able to:

Tutorial 1

- ❖ find domain and range of given functions
- ❖ sketch level curve and its graph of given functions
- ❖ sketch surface graph define by x , y , and z in 3 dimensions
- ❖ sketch the level surface graph of given functions

Tutorial 2

- ❖ verify the limit of given functions
- ❖ show that limit does not exist for a given function
- ❖ find the area R in which the given function is continuous

Tutorial 3

- ❖ find the first order partial derivatives of the given functions
- ❖ find the second-order partial derivative of the given functions

Tutorial 4

- ❖ find the approximation values by using partial derivative method
- ❖ find the partial derivative of the given functions by using the chain rule

Tutorial 5

- ❖ find the local extremum of the given functions

Table of Derivatives and Integrals

| Differentiation Rules | Indefinite Integrals |
|--|--|
| $\frac{d}{dx}[k] = 0, \quad k \text{ constant}$ | $\int k dx = kx + C$ |
| $\frac{d}{dx}[x^n] = nx^{n-1}$ | $\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$ |
| $\frac{d}{dx}[\ln x] = \frac{1}{x}$ | $\int \frac{dx}{x} = \ln x + C$ |
| $\frac{d}{dx}[\cos x] = -\sin x$ | $\int \sin x dx = -\cos x + C$ |
| $\frac{d}{dx}[\sin x] = \cos x$ | $\int \cos x dx = \sin x + C$ |
| $\frac{d}{dx}[\tan x] = \sec^2 x$ | $\int \sec^2 x dx = \tan x + C$ |
| $\frac{d}{dx}[\cot x] = -\operatorname{cosec}^2 x$ | $\int \operatorname{cosec}^2 x dx = -\cot x + C$ |
| $\frac{d}{dx}[\sec x] = \sec x \tan x$ | $\int \sec x \tan x dx = \sec x + C$ |
| $\frac{d}{dx}[\operatorname{cosec} x] = -\operatorname{cosec} x \cot x$ | $\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + C$ |
| $\frac{d}{dx}[e^x] = e^x$ | $\int e^x dx = e^x + C$ |
| $\frac{d}{dx}[\cosh x] = \sinh x$ | $\int \sinh x dx = \cosh x + C$ |
| $\frac{d}{dx}[\sinh x] = \cosh x$ | $\int \cosh x dx = \sinh x + C$ |
| $\frac{d}{dx}[\tanh x] = \operatorname{sech}^2 x$ | $\int \operatorname{sech}^2 x dx = \tanh x + C$ |
| $\frac{d}{dx}[\coth x] = -\operatorname{cosech}^2 x$ | $\int \operatorname{cosech}^2 x dx = -\coth x + C$ |
| $\frac{d}{dx}[\operatorname{sech} x] = -\operatorname{sech} x \tanh x$ | $\int \operatorname{sech} x \tanh x dx = \operatorname{sech} x + C$ |
| $\frac{d}{dx}[\operatorname{cosech} x] = -\operatorname{cosech} x \coth x$ | $\int \operatorname{cosech} x \coth x dx = -\operatorname{cosech} x + C$ |

Identities of Trigonometric Functions

1. $\sin^2 x + \cos^2 x = 1$

2. $1 + \tan^2 x = \sec^2 x$

3. $\cot^2 x + 1 = \operatorname{cosec}^2 x$

4. $\sin 2x = 2 \sin x \cos x$

5. $\cos 2x = \cos^2 x - \sin^2 x$

$$= 2 \cos^2 x - 1$$

$$= 1 - 2 \sin^2 x$$

6. $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$

7. $\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$

8. $\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$

9. $\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$

10. $2 \sin x \cos y = \sin(x + y) + \sin(x - y)$

11. $2 \sin x \sin y = -\cos(x + y) + \cos(x - y)$

12. $2 \cos x \cos y = \cos(x + y) + \cos(x - y)$

13. $\sin(-x) = -\sin x; \cos(-x) = \cos x; \tan x = \frac{\sin x}{\cos x}$



Penerbit Universiti
Universiti Teknikal Malaysia Melaka

ISBN 978-983-2948-32-2



9 789832 948322