

**STUDYING CONTRACT  
LEARNING PROGRAM OUTLINE  
LEARNING UNIT PROGRAM**

**COMPLEX FUNCTION**

**COURSE CODE: PAM 221**

**3 SCU**

**SEMESTER IV**



**BY:**

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**DEPARTMENT OF MATHEMATIC  
FACULTY OF MATHEMATIC AND NATURAL SCIENCES  
DIPONEGORO UNIVERSITY  
SEMARANG**

## LEARNING PROGRAM OUTLINE

TITLE OF COURSE : COMPLEX FUNCTION

CODE NUMBER/CREDIT : PAM 400 / 3

SHORT DESCRIPTION :

This course represent the 4<sup>th</sup> semester Mathematics Study Program S1 course which studying concepts which related to vector function and its application as a mathematical models form of real problem in Science and Tecnology, Industrial and Social Life.

GENERAL INSTRUCTIONAL AIM :

After studying this course, the student of Mathematics Program Study will be able to apply the calculus concepts of vector function in the real problem solving in Science and Teknologi , Industrial and Social Life.

No	Specific Instructional Aim	Subject	Sub Subject	Time Estimati on	References
1.	Given by general description about COMPLEX FUNCTION, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to explain solution substantiation and its relation with Calculus 3	Introduction: Course description, rule of lecturing	- Course description - Explaining of general and specific instructional aim	150 minute	Lecturing Book
2.	Given definition of vector function and vector space, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to explain congeniality vector function and vector space and its interpretation as model of real problem minimize 90% correctness	Vector function	- Definition of vector - Definition of vector space - Vector function as a mathematic model	150 minute	Lecturing Book  Reference
3.	Given definition and concept about limit and continuity of vector function, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to proof the existence of limit function and vector function continuity minimize 80% correctness	Vector function	- Limit and continuity of vector function	150 minute	Lecturing Book  Reference
4.	Given definition and interpretation of vector function derivative, the 4 <sup>th</sup> semester student of Mathematics Study	Derivative of vector function	- Definition and interpretation of vector function derivative	150 minute	Lecturing Book  Reference

	Program will be able to count and interpret vector function derivative and its application minimize 80% correctness		<ul style="list-style-type: none"> <li>- Rule of vector function derivative</li> <li>- Application of vector function derivative</li> </ul>		
5.	Given concept of directed derivative, gradient of vector scalar function, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to explain congeniality and get gradient vector of vector scalar function and its application minimize 80% correctness	Concept of vector function derivative	Gradient vector	150 minute	Lecturing Book Reference
6.	Given concept and definition of vector space divergence and curl, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to explain the meaning and count the divergence and curl of vector space and its application minimize 80% correctness	Concept of vector function derivative	<ul style="list-style-type: none"> <li>- Divergence of vector space</li> <li>- Curl of vector space</li> </ul>	150 minute	Lecturing Book Reference
7.	After get course about Mapple software application for vector function differential calculus computation, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to operate Mapple software to explore vector function and its derivative minimize 90% correctness	Exploration of vector function differential calculus with Mapple	<ul style="list-style-type: none"> <li>- Introduction of Mapple software</li> <li>- Exploration of vector function differential calculus with Mapple</li> </ul>	150 minute	Lecturing Book
8.	After get course at 1-7 week, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to solve mid semester exercise minimize 80% correctness	Middle test		150 minute	Lecturing Book Reference
9.	After given the concept and definition of vector function integral, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to explain and count vector function integral minimize 80% correctness	Concept and definition of vector function integral	<ul style="list-style-type: none"> <li>- Concept and definition of vector function integral</li> <li>- Rule of vector function integral computation</li> </ul>	150 minute	Lecturing Book Reference
10.	After given the concept of curve integral, the 4 <sup>th</sup> semester student of Mathematics Study Program will be able to count curve integral and its application minimize 80% correctness	Curve integral	<ul style="list-style-type: none"> <li>- Concept of curve integral</li> <li>- Application of curve integral</li> </ul>	150 minute	Lecturing Book Reference
11.	After given the concept of surface integral, the 4 <sup>th</sup> student of Mathematics Study Program will be able to count surface integral and its application minimize 80% correctness minimize 80% correctness	Surface integral	<ul style="list-style-type: none"> <li>- Concept of surface integral</li> <li>- Application of surface integral</li> </ul>	150 minute	Lecturing Book Reference
12.	After given the concept of	Volume integral	- Concept of volume	150	Lecturing

	volume integral, the 4 <sup>th</sup> student of Mathematics Study Program will be able to count volume integral and its application minimize 80% correctness		integral - Application of volume integral	minute	Book Reference
13.	After given the Gauss divergence and Stokes theorema, the 4 <sup>th</sup> student of Mathematics Study Program will be able to count surface and volume integral minimize 80% correctness	Gauss divergence theorema and Stokes theorema	- Gauss divergence and Stokes theorema - Application on surface and volume integral	150 minute	Lecturing Book Reference
14.	After given the Green theorema, the 4 <sup>th</sup> student of Mathematics Study Program will be able to count curve integral minimize 80% correctness	Green theorema	- Green theorema - Application on curve integral	150 minute	Lecturing Book Reference
15.	After get course about Mapple software application for vector function integral computation, the 4 <sup>th</sup> student of Mathematics Study Program will be able to operate Mapple software to count vector function integral minimize 90% correctness	Exploration of vector function integral with Mapple	- Introduction of Mapple software - Exploration of vector function integral with Mapple	150 minute	Lecturing Book
16.	After get course 9-14 week, the 4 <sup>th</sup> student of Mathematics Study Program will be able to do the final test minimize 80% correctness	Final Test		150 minute	Lecturing Book Reference

Daftar Pustaka:

1. Budnick, F.S, *Applied Mathematics for Busines, Economics and Social Sciences*, Third edition, McGraw-Hill, Singapore, 1988
2. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
3. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, , Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
4. Kreyszig, E, and E.J. Norminton, *Advanced Engineering Mathematics – Maple Computer Manual*, 7<sup>th</sup> edition, John Wiley & Sons, Inc, Canada, 1994
5. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 1<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

Given by general description about COMPLEX FUNCTION, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to explain solution substantion and its relation with Calculus 3 Given by general description about COMPLEX FUNCTION, minimize 80% correctness.

B. Subject : Introduction: Course Description and Rule of Lecturing

C. Sub Subject :

- Course Description
- General and Specific Instructionsl Aim, Contract of Lecturing.

D. Lecturing Activity :

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing about Calculus 3.	Listening	
Presentation	1. Explaining short description of COMPLEX FUNCTION . 2. Explaining relation between COMPLEX FUNCTION and Calculus 3. 3. Explaining General, Specific Instructional Aim and Contract of Lecturing	Paying attention and writing Paying attention and writing Paying attention and writing	Blackboard. OHP/LCD
Closing	1. Making handsout of solution. 2. Giving introduction to next lecturing.	Paying attention and writing Doing exercise and discussing	Blackboard. Assignment book

E. Evaluation:

F. Reference:

1. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
2. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

### LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 2<sup>st</sup>

**A. Instructional Aim**

1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social.

2. Specific

Given definition of vector function and vector space, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to explain congeniality vector function and vector space and its interpretation as model of real problem minimize 90% correctness

**B. Subject** : Vector function

**C. Sub Subject:**

- Definition of vector
- Definition of vector space
- Vector function as a mathematic model

**D. Lecturing Activity:**

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about multivariable function.	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining definition of vector function and vector space 2. Explaining vector function interpretation as a mathematics model of real problem.	Paying attention and writing Paying attention and writing	Blackboard. OHP/LCD
Closing	1. Giving team task about example of vector function as a real problem mathematic model. 2. Giving introduction to next learning.	Paying attention and writing Doing exercise and discussing	Blackboard. Assignment book

**E. Evaluasi:**

Instrument using: check list to evaluate teamwork task

**F. Reference :**

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION

Code of Course / Credit : PAM 400 / 3

Time of Lecturing : 150 Minutes

Lecturing : 3<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

Given definition and concept about limit and continuity of vector function, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to proof the existence of limit function and vector function continuity minimize 80% correctness.

B. Subject : Vector function

C. Sub Subject:

- Limit and continuity of vector function

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about vector function.	Listening and writing	Blackboard. OHP/LCD
Presentation	<ol style="list-style-type: none"> <li>1. Explaining about concept and definition of vector function limit</li> <li>2. Explaining definition and way of proofing about vector function continuity</li> <li>3. Giving example way of proofing limit existence and vector function continuity</li> </ol>	Paying attention and writing Paying attention and writing Discussing	Blackboard. OHP/LCD
Closing	<ol style="list-style-type: none"> <li>1. Giving individual task</li> <li>2. Giving introduction to next learning</li> </ol>	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for student activity in discussing.

### F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 4<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

Given definition and interpretation of vector function derivative, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to count and interpret vector function derivative and its application minimize 80% correctness

B. Subject : Derivative of vector function

C. Sub Subject:

- Definition and interpretation of vector function derivative
- Rule of vector function derivative
- Application of vector function derivative

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about vector function limit	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining about concept and definition of vector function derivative and its interpretation. 2. Giving example to interprate vector function derivative and its application in the real problem.	Paying attention and writing Paying attention and writing Giving idea	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing	Blackboard. Assignment book

E. Evaluation:

Evaluation for individual homework.

F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.



## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 5<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

Given concept of directed derivative, gradient of vector scalar function, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to explain congeniality and get gradient vector of vector scalar function and its application minimize 80% correctness

B. Subject : Concept of vector function derivative

C. Sub Subject:

- Gradient vector

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about vector function Menjelaskan ulang tentang pengertian turunan parsial dan turunan fungsi vektor	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Reviewing concept directed derivative. 2. Explaining about concept and definition of gradient vector. 3. Giving example in the real problem	Paying attention and writing Paying attention and writing Giving idea	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing .	Blackboard. Assignment book

E. Evaluation :

Evaluation for individual homework.

F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 6<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

Given concept and definition of vector space divergence and curl, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to explain the meaning and count the divergence and curl of vector space and its application minimize 80% correctness

B. Subject : Concept of vector function derivative

C. Sub Subject:

- Divergence of vector space
- Curl of vector space

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about vector function Menjelaskan ulang tentang pengertian turunan parsial dan turunan fungsi vektor	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining about definition of vector space 2. Explaining about definition of vector space curl 3. Giving example in the real problem.	Paying attention and writing  Paying attention and writing  Giving idea	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for individual homework.

### F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 7<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After get course about Mapple software application for vector function differential calculus computation, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to operate Mapple software to explore vector function and its derivative minimize 90% correctness

B. Subject : Exploration of vector function differential calculus with Mapple

C. Sub Subject:

- Introduction of Mapple software
- Exploration of vector function differential calculus with Mapple

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Explaining the rule of lab work	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining the using rule of Mapple. 2. Helping lab work process	Operating computer to explore multivariable calculus	Blackboard. OHP/LCD Laboratorium computer
Closing	1. Giving labwork evaluation 2. Giving individual task	Paying attention and writing	Blackboard. Assignment book

E. Evaluation:

Evaluation for individual homework.

F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
Code of Course / Credit : PAM 400 / 3  
Time of Lecturing : 150 Minutes  
Lecturing : 8<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After get course at 1-7 week, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to solve mid semester exercise minimize 80% correctness

B. Subject : Middle test

C. Sub Subject:

- Materi mid dari materi pertemuan ke 1 sampai ke 7.

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Explaining the rule of evaluation	Listening and writing	Blackboard. OHP/LCD
Presentation	Giving evaluation worksheet.	Doing MID exercise	Evaluation sheet
Closing	1. Giving description about the middletest answer. 2. Giving introduction to next learning	Paying attention and writing	Blackboard. Assignment book

E. Evaluation:

Evaluation for midletest worksheet.

F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 9<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the concept and definition of vector function integral, the 4<sup>th</sup> semester semester student of Mathematics Study Program will be able to explain and count vector function integral minimize 80% correctness

B. Subject : Concept and definition of vector function integral

C. Sub Subject:

- Concept and definition of vector function integral
- Rule of vector function integral computation

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Explaining the middletest yield	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Reviewing about fold integral. Explaining about concept and definition of vector function integral and its counting rule 2. Leading disscusion about vector function integral interpretation in the real problem	Listening and writing   Discussing	Blackboard.  OHP/LCD
Closing	1. Giving team task 2. Giving introduction to next learning	Paying attention and writing	Blackboard.  Assignment book

E. Evaluation:

Evaluation for student activity in discussing

F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
Code of Course / Credit : PAM 400 / 3  
Time of Lecturing : 150 Minutes  
Lecturing : 10<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the concept of curve integral, the 4<sup>th</sup> semester student of Mathematics Study Program will be able to count curve integral and its application minimize 80% correctness

B. Subject : Curve integral

C. Sub Subject:

- Concept of curve integral
- Application of curve integral

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about vector function integral	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining about concept and definition of curve integral 2. Giving example of its counting.	Listening and writing	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing	Blackboard. Assignment book

E. Evaluation:

Penilaian terhadap tugas yang dikumpulkan pada pertemuan berikutnya.

F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 11<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the concept of surface integral, the 4<sup>th</sup> student of Mathematics Study Program will be able to count surface integral and its application minimize 80% correctness minimize 80% correctness

B. Subject : Surface integral

C. Sub Subject:

- Concept of surface integral
- Application of surface integral

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about doubled integral	Listening and writing	Blackboard. OHP/LCD
Presentation	<ol style="list-style-type: none"> <li>1. Explaining about concept and definition of surface integral and its counting</li> <li>2. Leading disscusion about surface integral interpretation in the real problem</li> <li>3. Giving example of its counting.</li> </ol>	Listening and writing  Discussing	Blackboard. OHP/LCD
Closing	<ol style="list-style-type: none"> <li>1. Giving individual task</li> <li>2. Giving introduction to next learning</li> </ol>	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for student activity in discussing.

### F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION

Code of Course / Credit : PAM 400 / 3

Time of Lecturing : 150 Minutes

Lecturing : 12<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the concept of volume integral, the 4<sup>th</sup> student of Mathematics Study Program will be able to count volume integral and its application minimize 80% correctness

B. Subject : Volume integral

C. Sub Subject:

- Concept of volume integral
- Application of volume integral

D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about tripled integral	Listening and writing	Blackboard. OHP/LCD
Presentation	<ol style="list-style-type: none"> <li>1. Explaining about concept and definition of volume integral and its counting rule</li> <li>2. Leading disscusion about volume integral interpretation in the real problem</li> <li>3. Giving example of its counting.</li> </ol>	Listening and writing  Discussing	Blackboard. OHP/LCD
Closing	<ol style="list-style-type: none"> <li>1. Giving individual task</li> <li>2. Giving introduction to next learning</li> </ol>	Paying attention and writing .	Blackboard. Assignment book

E. Evaluation:

Evaluation for student activity in discussing

F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.



## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 400 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 13<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the Gauss divergence and Stokes theorema, the 4<sup>th</sup> student of Mathematics Study Program will be able to count surface and volume integral minimize 80% correctness

B. Subject : Gauss divergence theorema and Stokes theorema

C. Sub Subject:

- Gauss divergence and Stokes theorema
- Application on surface and volume integral

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about tripled integral	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining Gauss divergence theorema and Stokes theorema its related with surface and volume integral . 2. Giving example of its counting	Listening and writing	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing .	Blackboard. Assignment book

### E. Evaluation:

Evaluation for individual task.

### F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
Code of Course / Credit : PAM 221 / 3  
Time of Lecturing : 150 Minutes  
Lecturing : 14<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After given the Green theorema , the 4<sup>th</sup> student of Mathematics Study Program will be able to count curve integral minimize 80% correctness

B. Subject : Green theorema

C. Sub Subject:

- Green theorema
- Application on curve integral

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Reviewing last learning about doubled integral	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining Green Theorema and its related with curve integral 2. Giving example of its counting	Listening and writing	Blackboard. OHP/LCD
Closing	1. Giving individual task 2. Giving introduction to next learning	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for individual task.

### F. Reference:

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
 Code of Course / Credit : PAM 221 / 3  
 Time of Lecturing : 150 Minutes  
 Lecturing : 15<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After get course about Mapple software application for vector function integral computation, the 4<sup>th</sup> student of Mathematics Study Program will be able to operate Mapple software to count vector function integral minimize 90% correctness

B. Subject : Exploration of vector function integral with Mapple

C. Sub Subject:

- Introduction of Mapple software
- Exploration of vector function integral with Mapple

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Explaining the rule of lab work	Listening and writing	Blackboard. OHP/LCD
Presentation	1. Explaining the using rule of Mapple. 2. Helping lab work process	Operating computer to explore multivariable calculus	Blackboard. OHP/LCD Laboratorium computer
Closing	1. Giving practice laboratory evaluation 2. Giving individual task	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for individual task

### F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : COMPLEX FUNCTION  
Code of Course / Credit : PAM 221 / 3  
Time of Lecturing : 150 Minutes  
Lecturing : 16<sup>st</sup>

### A. Instructional Aim

#### 1. General

After studying this course, graduate student of Mathematics Program Study will be able to apply calculus concepts of vector function in reality problem solving in Science and Tecnology, Industrial, and Social Life.

#### 2. Specific

After get course 9-14 week, the 4<sup>th</sup> student of Mathematics Study Program will be able to do the final test minimize 80% correctness

B. Subject : Final Test

C. Sub Subject:

- Materi mid dari materi pertemuan ke 9 sampai ke 14

### D. Lecturing Activity:

Step	Lecturing Activity	Student Activity	Media & Equipment
Intoduction	Explaining evaluation rule.	Listening and writing	Blackboard. OHP/LCD
Presentation	Giving final test worksheet	Doing final test exercise	Evaluation sheet
Closing	Giving description of final test answer ujian	Paying attention and writing	Blackboard. Assignment book

### E. Evaluation:

Evaluation for final test worksheet.

### F. Reference :

1. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
2. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Lecturing Book, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
3. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

## CONTRACT OF LECTURING

NAME OF COURSE : **COMPLEX FUNCTION**  
KODE OF COURSE : **PAM 221**  
LECTURE : **Drs. KARTONO, MSi**  
SEMESTER : **IV**  
DAY/TIME :  
PLACE : **Room**

### 1. Utility of Course

Phenomenons in life of reality often in form of functional relation between dependen and independen variable which beside have value but also have direction . An phenomenon can represent relation depended among one dependen variable with mpre than one dependen variable ( variable multi). The course COMPLEX FUNCTION useful to be able to explain, depicting graph, analysing the nature of and behavior of the phenomenon which expressed as function of vektor. Therefore Calculus IV is obliged to be gone through by student of S1 PS Mathematics as continuation of Calculus 3 which only studying about variable scalar function many and as basis for go through next course which related to solution of vector function.

### 2. Lecturing Description

The scope COMPLEX FUNCTION are definition of vector function and curve and its surface, function definition, concept and definition of derivative of vector function which preceded with concept of limit and continuity vector function and its application to solving real problem, consept and congeniality also integral of volume with its application. At the end of lecturing will terminate with recognition of software application to supporting computing operation and its visualization.

### 3. Instructional Aim

General:

After studying this course, the student of Mathematics Program Study will be able to apply the calculus concepts of vector function in the real problem solving in Science and Teknologi , Industrial and Social Life

Specific:

10	- Integral kurva	Dosen ke 2
11	- Integral permukaan	Kartono
12	- Integral volume - Kuis	Dosen ke 2
13	- Teorema Divergensi Gauss dan Stokes dan kaitanya dengan integral permukaan dan volume	Dosen ke 2
14	- Teorema Green dan kaitannya dengan integral kurva.	
15	- Pengenalan software Maple. - Eksplorasi integral fungsi vektor dengan Maple	Tim
16	Ujian semester dengan materi minggu ke-9 sampai ke-14	Tim

4. Pada akhir perkuliahan ke-4 dan ke-12 diadakan kuis. Tujuan kuis ini untuk menjajaki kesiapan mahasiswa dalam menghadapi ujian tengah semester maupun ujian semester.
5. Ujian tengah semester akan diadakan pada perkuliahan ke-8 dengan materi separo.
6. Ujian akhir semester dengan materi separo berikutnya akan diadakan terjadwal.

### 8. Evaluation Criteria

Penilaian yang akan dilakukan oleh pengampu menggunakan kombinasi acuan normal dan patokan. Batas lulus dengan nilai C adalah nilai 55, kemudian dengan memakai acuan normal untuk mendistribusikan nilai diatas 55 dengan nilai A, AB, B, BC dan dibawah 55 dengan nilai CD, D, E

Dalam menentukan nilai akhir akan digunakan pembobotan sebagai berikut:

Tugas mandiri	: 10 %
Kuis	: 10 %
Ujian tengah semester	: 40 %
Ujian akhir semester	: 40 %
Kehadiran	: 0 %

### 9. Schedule of Lecturing

Pertemuan	Pokok Bahasan	Pengampu
1	- Deskripsi mata kuliah - Penjelasan TIU, TI dan Kontrak Kuliah	Kartono
2	- Definisi fungsi vektor dan medan vektor - Fungsi vector sebagai model matematika	Kartono
3	- Limit dan Kontinuitas fungsi vektor,	Kartono
4	- Definisi dan Interpretasi Turunan fungsi vektor. - Aturan-aturan dalam Turunan Parsial. - Turunan Total - Kuis	Kartono
5	- Vektor Gradien	Dosen ke 2
6	- Divergensi medan vector dan Curl medan vektor	Dosen ke 2
7	- Pengenalan software Maple. - Eksplorasi kalkulus diferensial vektor dengan Maple	Tim
8	Mid semester dengan materi minggu ke-1 sampai ke-7	Tim
9	- Definisi integral fungsi vektor - Aturan perhitungan dalam integral fungsi vektor	Kartono

mahasiswa diberi tes formatif. Dosen mengidentifikasi kesulitan yang dihadapi dalam pengerjaan tes dan memberi penjelasan kembali materi yang belum dimengerti serta rangkuman materi perkuliahan.

Satu topik perkuliahan akan diberikan kepada seluruh mahasiswa, beberapa mahasiswa ditunjuk untuk mempresentasikan dan dibahas bersama dalam kuliah.

## 6. References

Buku bacaan sebagai referensi antara lain:

1. Budnick, F.S, *Applied Mathematics for Busines, Economics and Social Sciences*, Third edition, McGraw-Hill, Singapore, 1988
2. Holder, De Franca, Pasachoff, *Multivariable Calculus*, 2<sup>th</sup> edition, ITP, California, 1995.
3. Kartono, Solikhin Zaki, *Kalkulus Peubah Banyak*, Buku Ajar, Jurusan Matematika FMIPA UNDIP, Semarang, 2004.
4. Kreyszig, E, and E.J. Norminton, *Advanced Engineering Mathematics – Maple Computer Manual*, 7<sup>th</sup> edition, John Wiley & Sons, Inc, Canada, 1994
5. Stewart, J, *Calculus*, 4<sup>th</sup> edition, ITP, Singapore, 1999.

Disamping buku-buku bacaan tersebut, akan dibagikan artikel-artikel atau penugasan penelusuran materi melalui internet.

## 7. Tasks

1. Sebelum perkuliahan dimulai mahasiswa sudah membaca topik yang akan dibahas dan menyiapkan beberapa contoh dalam kehidupan sehari-hari sesuai dengan topik saat itu.
2. Setiap selesai perkuliahan, mahasiswa diberi latihan dan dikumpulkan pada awal perkuliahan berikutnya. Setelah dikoreksi dosen, hasilnya dikembalikan kepada mahasiswa.
3. Tugas mandiri yang berupa mencari contoh soal penerapan konsep yang telah dipelajari pada penyelesaian masalah dunia nyata, ditulis dalam format laporan dan setiap mahasiswa harus berbeda. Tujuan dari tugas ini adalah agar mahasiswa dapat melatih tanggung jawab pribadi dan kolektif. Karena harus berbeda maka diharapkan terjadi diskusi diantara mahasiswa untuk masing-masing mempresentasikan tugasnya agar tidak ditiru temannya. Tugas yang sama akan dinyatakan gugur.



Setelah mengikuti mata kuliah ini, Mahasiswa S1 PS Matematika semester 4 akan dapat:

1. menjelaskan substansi pembahasan Kalkulus 4 yang berkaitan dengan Kalkulus 3
2. menjelaskan pengertian fungsi vektor dan medan vektor serta interpretasinya sebagai salah satu model masalah nyata
3. membuktikan eksistensi limit fungsi dan membuktikan kontinuitas fungsi vektor
4. menghitung dan menginterpretasi turunan fungsi vektor, vektor .gradien, divergensi medan vektor dan curl medan vektor.
5. menjelaskan konsep dan menghitung integral fungsi vektor
6. menghitung integral kurva, integral permukaan dan integral volume.
7. menjelaskan Teorema divergensi Gauss dan Teorema Stokes dan kaitannya dengan integral permukaan dan integral volume.
8. menjelaskan teorema Green dan kaitannya dengan integral kurva.
9. mengoperasikan software Maple untuk mengeksplorasi fungsi vektor.

#### **4. Subject Organization.**

Urutan pembahasan materi adalah

1. Deskripsi mata kuliah dan penjelasan TIU, TI dan Kontrak Kuliah
2. Definisi fungsi vektor dan. sebagai model matematika
3. Limit dan Kontinuitas fungsi vektor
4. Definisi dan Interpretasi Turunan fungsi vektor., Aturan-aturan dalam Turunan fungsi vektor.
5. Vektor Gradien, Divergensi medan vektor dan Curl medan vektor
6. Definisi integral fungsi vektor dan aturan perhitungannya.
8. Integral kurva. Integral permukaan, integral volume.
9. Pengenalan Maple dan eksplorasi kalkulus 4

#### **5. Strategy of Lecturing**

Pada awal perkuliahan akan diberikan deskripsi perkuliahan beserta contoh pada kehidupan sehari-hari dan tujuan instruksional serta uraian materi secara singkat untuk membangun kerangka berfikir mahasiswa. Untuk melibatkan mahasiswa secara aktif dalam proses belajar dan mencapai kesimpulan kelompok, digunakan metode diskusi, dimana dosen sebagai fasilitator dan mahasiswa diberi latihan mencari contoh pada lingkungannya sendiri yang berhubungan dengan materi yang diberikan. Selanjutnya