# STUDYING CONTRACT
# LEARNING PROGRAM OUTLINE
# LEARNING PROGRAM UNIT

## CALCULUS IV

**COURSE CODE: PAM 400**

**3 SCU**

**SEMESTER IV**


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## LEARNING PROGRAM OUTLINE

TITLE OF COURSE : CALCULUS 4

CODE NUMBER/CREDIT : PAM 400 / 3

SHORT DESCRIPTION :

This course represent the 4th 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 Estimation | References |
|---|---|---|---|---|---|
| 1. | Given by general description about Calculus 4, the 4th semester student of Mathematics Study Programwill be able to explain solution substantion and its relation with Calculus 3 | Introduction: Course description, rule of lecturing | - Course description<br>- Explaining of general and specific instructional aim | 150 minute | Lecturing Book |
| 2. | Given definition of vector function and vector space, the 4th 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<br>- Definition of vector space<br>- Vector function as a mathematic model | 150 minute | Lecturing Book<br><br>Reference |
| 3. | Given definition and concept about limit and continuity of vector function, the 4th 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<br><br>Reference |
| 4. | Given definition and interpretation of vector function derivative, the 4th semester student of Mathematics Study Program will be able to count | Derivative of vector function | - Definition and interpretation of vector function derivative<br>- Rule of vector | 150 minute | Lecturing Book<br><br>Reference |

| | | | | | |
|---|---|---|---|---|---|
| | and interpret vector function derivative and its application minimize 80% correctness | | function derivative<br>- Application of vector function derivative | | |
| 5. | Given concept of directed derivative, gradient of vector scalar function, the 4th 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<br><br>Reference |
| 6. | Given concept and definition of vector space divergence and curl, the 4th 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 | - Divergence of vector space<br>- Curl of vector space | 150 minute | Lecturing Book<br><br>Reference |
| 7. | After get course about Mapple software application for vector function differential calculus computation, the 4th 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 calculuc with Mapple | - Introduction of Mapple software<br>- Exploration of vector function differential calculuc with Mapple | 150 minute | Lecturing Book |
| 8. | After get course at 1-7 week, the 4th semester student of Mathematics Study Program will be able to solve mid semester exercise minimize 80% correctness | Middle test | | 150 minute | Lecturing Book<br><br>Reference |
| 9. | After given the concept and definition of vector function integral, the 4th semester 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 | - Concept and definition of vector function integral<br>- Rule of vector function integral computation | 150 minute | Lecturing Book<br><br>Reference |
| 10. | After given the concept of curve integral, the 4th semester student of Mathematics Study Program will be able to count curve integral and its application minimize 80% correctness | Curve integral | - Concept of curve integral<br>- Application of curve integral | 150 minute | Lecturing Book<br><br>Reference |
| 11. | After given the concept of surface integral, the 4th student of Mathematics Study Program will be able to count surface integral and its application minimize 80% correctness minimize 80% correctness | Surface integral | - Concept of surface integral<br>- Application of surface integral | 150 minute | Lecturing Book<br><br>Reference |
| 12. | After given the concept of volume integral, the 4th student | Volume integral | - Concept of volume integral | 150 minute | Lecturing Book |

| | | | | | |
|---|---|---|---|---|---|
| | of Mathematics Study Program will be able to count volume integral and its application minimize 80% correctness | | - Application of volume integral | | Reference |
| 13. | After given the Gauss divergence and Stokes theorema, the 4th 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<br>- Application on surface and volume integral | 150 minute | Lecturing Book<br><br>Reference |
| 14. | After given the Green theorema , the 4th student of Mathematics Study Program will be able to count curve integral minimize 80% correctness | Green theorema | - Green theorema<br>- Application on curve integral | 150 minute | Lecturing Book<br><br>Reference |
| 15. | After get course about Mapple software application for vector function integral computation, the 4th 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<br>- Exploration of vector function integral with Mapple | 150 minute | Lecturing Book |
| 16. | After get course 9-14 week, the 4th student of Mathematics Study Program will be able to do the final test minimize 80% correctness | Final Test | | 150 minute | Lecturing Book<br><br>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,* 2th 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,* 7th edition, John Wiley & Sons, Inc, Canada, 1994
5. Stewart, J, *Calculus,* 4th edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 1st

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 Calculus 4, the 4th semester student of Mathematics Study Program will be able to explain solution substantion and its relation with Calculus 3 Given by general description about Calculus 4, 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 Calculus 4 .<br>2. Explaining relation between Calculus 4 and Calculus 3.<br>3. Explaining General, Specific Inctructional Aim and Contract of Lecturing | Paying attention and writing<br>Paying attention and writing<br>Paying attention and writing | Blackboard.<br>OHP/LCD |
| Closing | 1. Making handsout of solution.<br>2. Giving introduction to next lecturing. | Paying attention and writing<br>Doing exercise and discussing | Blackboard.<br>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,* 4th edition, ITP, Singapore, 1999.

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 2st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining definition of vector function and vector space<br>2. Explaining vector function interpretation as a mathematics model of real problem. | Paying attention and writing<br>Paying attention and writing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving team task about example of vector function as a real problem mathematic model.<br>2. Giving introduction to next learning. | Paying attention and writing<br>Doing exercise and discussing | Blackboard.<br><br>Assignment book |

E. Evaluasi:

Instrument using: check list to evaluate teamwork task

F. Reference :


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 3st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining about concept and definition of vector function limit<br>2. Explaining definition and way of proofing about vector function continuity<br>3. Giving example way of proofing limit existence and vector function continuty | Paying attention and writing<br>Paying attention and writing<br>Discussing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:
Evaluation for student activity in discussing.

F. Reference :


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 4st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining about concept and definition of vector function derivative and its interpretation.<br>2. Giving example to interprate vector function derivative and its application in the real problem. | Paying attention and writing<br>Paying attention and writing<br>Giving idea | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for individual homework.

F. Reference :


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 5st

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 4th 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<br>Menjelaskan ulang tentang pengertian turunan parsial dan turunan fungsi vektor | Listening and writing | Blackboard.<br><br>OHP/LCD |
| Presentation | 1. Reviewing concept directed derivative.<br>2. Explaining about concept and definition of gradient vector.<br>3. Giving example in the real problem | Paying attention and writing<br>Paying attention and writing<br>Giving idea | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing<br>. | Blackboard.<br><br>Assignment book |

E. Evaluation :
Evaluation for individual homework.

F. Reference:


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 6st

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 4th 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<br>Menjelaskan ulang tentang pengertian turunan parsial dan turunan fungsi vektor | Listening and writing | Blackboard.<br><br>OHP/LCD |
| Presentation | 1. Explaining about definition of vector space<br>2. Explaining about definition of vector space curl<br>3. Giving example in the real problem. | Paying attention and writing<br><br>Paying attention and writing<br><br>Giving idea | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:
Evaluation for individual homework.

F. Reference :


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 7st

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 4th 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 calculuc with Mapple

C. Sub Subject:

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

D. Lecturing Activity:

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

E. Evaluation:

Evaluation for individual homework.

F. Reference:


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 8st

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 4th 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.<br><br>OHP/LCD |
| Presentation | Giving evaluation worksheet. | Doing MID exercise | Evaluation sheet |
| Closing | 1. Giving description about the middletest answer.<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for midletest worksheet.

F. Reference :


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 9st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Reviewing about fold integral. Explaining about concept and definition of vector function integral and its counting rule<br>2. Leading disscusion about vector function integral interpretation in the real problem | Listening and writing<br><br>Discussing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving team task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for student activity in discussing

F. Reference:


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : $10^{st}$

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 $4^{th}$ 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining about concept and definition of curve integral<br>2. Giving example of its counting. | Listening and writing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Penilaian terhadap tugas yang dikumpulkan pada pertemuan berikutnya.

F. Reference:


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 11st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining about concept and definition of surface integral and its counting<br>2. Leading disscusion about surface integral interpretation in the real problem<br>3. Giving example of its counting. | Listening and writing<br><br>Discussing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for student activity in discussing.

F. Reference :


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 12st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining about concept and definition of volume integral and its counting rule<br>2. Leading disscusion about volume integral interpretation in the real problem<br>3. Giving example of its counting. | Listening and writing<br><br>Discussing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing<br>. | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for student activity in discussing

F. Reference :


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 13st

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 4th 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.<br>OHP/LCD |
| Presentation | 1. Explaining Gauss divergence theorema and Stokes theorema its related with surface and volume integral .<br>2. Giving example of its counting | Listening and writing | Blackboard.<br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing<br>. | Blackboard.<br>Assignment book |

E. Evaluation:
Evaluation for individual task.

F. Reference:


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 14st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining Green Theorema and its related with curve integral<br>2. Giving example of its counting | Listening and writing | Blackboard.<br><br>OHP/LCD |
| Closing | 1. Giving individual task<br>2. Giving introduction to next learning | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for individual task.

F. Reference:


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

# LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 15st

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 4th 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.<br><br>OHP/LCD |
| Presentation | 1. Explaining the using rule of Mapple.<br>2. Helping lab work process | Operating computer to explorate multivariable calculus | Blackboard.<br><br>OHP/LCD<br><br>Laboratorium computer |
| Closing | 1. Giving practice laboratory evaluation<br>2. Giving individual task | Paying attention and writing | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for individual task

F. Reference :


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

## LEARNING UNIT PROGRAM

Name of Course : Calculus 4
Code of Course / Credit : PAM 400 / 3
Time of Lecturing : 150 Minutes
Lecturing : 16st

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 4th 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.<br><br>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<br>. | Blackboard.<br><br>Assignment book |

E. Evaluation:

Evaluation for final test worksheet.

F. Reference :


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

# CONTRACT OF LECTURING

| | |
|---|---|
| NAME OF COURSE | : **CALCULUS 4** |
| KODE OF COURSE | : **PAM 400** |
| 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 Calculus 4 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 Decription

The scope Calculus 4 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: