

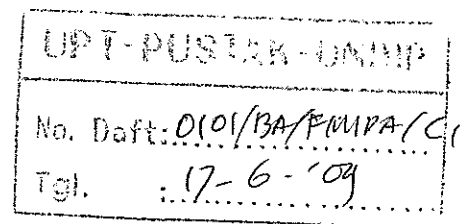
**STUDYING CONTRACT
LEARNING PROGRAM OUTLINE
LEARNING PROGRAM UNIT**

THEORY OF DIFFERENTIAL EQUATION

COURSE CODE: PAM 413

3 SCU

SEMESTER VI



BY:

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**DEPARTEMENT OF MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
DIPONEGORO UNIVERSITY
SEMARANG**

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION

COURSE CODE : MAT 217

CREDIT : 3

MEETING TIME : 150 minutes,

MEETING : first

A. INSTRUCTIONAL OBJECTIVES

1. GENERAL: After following this course, the students to be able to describe some concepts of real functions sequences.
2. SPECIFIC: After lecturing, the students to be able to:
 - describe uniform convergence of the real functions sequence.
 - describe pointwise convergence of the real functions sequences
 - explain M-test Weierstrass.

B. TOPIC : Real functions sequence

C. SUBTOPIC:

- Uniform convergence
- pointwise konvergence

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Describing specific instructional objectives and its relation	Paying attentions, noting	White board and OHP,
PRESENTATION	<ul style="list-style-type: none"> - describing the concepts of real functions sequences - describing the pointwise convergence concepts of real functions sequences - describing M-test theorem Weierstrass 	Paying attentions, listening and noting	White board, OHP
CLOSING	<ul style="list-style-type: none"> - asking for the student to explain again - giving assignment 	Discussing and doing	White board, OHP

E. EVALUATION : assignments, test formatives or questions and answers to know effectiveness of the course

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes,
 MEETING : 2th

B. INSTRUCTIONAL OBJECTIVES

1. GENERAL: After following this course, the students to be able to describe some concepts of real functions of two variables of sequences and Lipschitz property.
2. SPECIFIC: After lecturing, the students to be able to:
 - describe continuous functions of two variable
 - describe bounded two variables functions in closed rectangle plane
 - explain two variable functions which satisfy Lipschitz condition

B. TOPIC : functions of two variable

C. SUBTOPIC:

- continuous functions
- Lipschitz condition

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing the concepts of real functions of two variables - describing functions of two variables satisfy Lipschitz condition	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for the student to explain again - giving assignment	Discussing and doing	White board, OHP

E. EVALUATION : assignments, test formatives or questions and answers to know effectiveness of the course

F. REFERENCES

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes,
MEETING : 3th

C. INSTRUCTIONAL OBJECTIVES

1. GENERAL: After following this course, the students to be able to describe the existence fundamental theorem to solution
2. SPECIFIC: After lecturing, the students to be able to:
 - describe the existence fundamental theorem to solution
 - prove the existence fundamental theorem to solution

B. TOPIC : existence of solution

C. SUBTOPIC:

- fundamental theorem of existence of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing and proving the existence fundamental theorem of first order differential equation	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for the student to explain again - giving assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments, test formatives or questions and answers to know effectiveness of the course

F. REFERENCES

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes,
 MEETING : 4th

A. INSTRUCTIONAL OBJECTIVES

1. GENERAL: After this course, the students to be able to solve some differential equation based on the existence fundamental theorem
2. SPECIFIC: After lecturing, the students to be able to:
 - explain the existence fundamental theorem to solution
 - solve differential equation based on the existence fundamental theorem

B. TOPIC : existence of solution

C. SUBTOPIC:

- fundamental theorem of existence of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- explain the existence fundamental theorem to solution - solve differential equation based on the existence fundamental theorem	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for the student to explain again - giving assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments, test formatives or questions and answers to know effectiveness of the course

F. REFERENCES

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes
 MEETING : 5th

A. INSTRUCTIONAL OBJECTIVES:

- 1 GENERAL: After the course, students are able to explain the solution defined in unbounded domain.
- 2 SPECIFIC: After the course, students are able to:
 - describe the existence of solution defined in unbounded domain
 - solve a differential equation defined in unbounded domain

B. TOPIC: Continuity of solution

C. SUBTOPIC: Continuity of solution defined in unbounded domain

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing the existence of continuous solution in open and unbounded interval	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION : assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes
 MEETING : 6th

A. INSTRUCTIONAL OBJECTIVES:

- 1 GENERAL: After the course, students are able to explain the solution of differential equation depend on initial condition
- 2 SPECIFIC: After the course, students are able to:
 - a. describe and prove the existence of solution depend on initial condition
 - b. identify the solution by considering with initial condition

B. TOPIC: dependency of solution

C. SUBTOPIC: dependency of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describe and prove the existence of solution depend on initial condition - identify the solution by considering with initial condition	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes
 MEETING : 7th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the solution of differential equation depend on initial condition
2. SPECIFIC: After the course, students are able to:
 - describe and prove the existence of solution depend on initial condition
 - identify the solution by considering with initial condition

B. TOPIC: dependency of solution

C. SUBTOPIC: dependency of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing and prove the existence of solution depend on initial condition - identifying the solution by considering with initial condition	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes
 MEETING : 8th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the solution of differential equation depend on the function
2. SPECIFIC: After the course, students are able to:
 - describe and prove the existence of solution differential equation depend on the function
 - identify the solution by considering with a function

B. TOPIC: dependency of solution

C. SUBTOPIC: dependency of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing and prove the existence of solution depend on the function - identifying the solution by considering with a function	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
 COURSE CODE : MAT 217
 CREDIT : 3
 MEETING TIME : 150 minutes
 MEETING : 9th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the existence and uniqueness of solution of the higher order differential equation
2. SPECIFIC: After the course, students are able to:
 - describe and prove the existence and uniqueness of solution of the higher differential equation
 - identify the solution of the higher order differential equation

B. TOPIC: existence and uniqueness

C. SUBTOPIC: existence and uniqueness of solution

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing and prove the existence of solution of the higher order differential equation - identifying the solution of the higher order differential equation	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes
MEETING : 10th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the behavior of solution without know explicitly the solution
2. SPECIFIC: After the course, students are able to:
 - describe and depict graph of the system in phase plane

B. TOPIC: phase plane

C. SUBTOPIC: understanding phase plane

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing the autonomous differential equation - describing the understanding phase plane and giving examples	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes
MEETING : 11th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the behavior of solution of the system differential equation
2. SPECIFIC: After the course, students are able to:
 - describe and depict graph of the system in phase plane
 - determine critical points

B. TOPIC: critical points

C. SUBTOPIC: understanding and types of critical point

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing the critical points of autonomous differential equation - giving examples	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes
MEETING : 12th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the behavior of solution of the system differential equation
2. SPECIFIC: After the course, students are able to:
 - describe stability of critical points of the system in phase plane

B. TOPIC: Stability of critical points

C. SUBTOPIC: Definition of stability of critical points

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing definition and types of stability of the critical points of autonomous differential equation - giving examples	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes
MEETING : 13th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to explain the behavior of solution of the non linear differential equation non linear
2. SPECIFIC: After the course, students are able to:
 - describe stability of critical points of the non linear differential equation non linear

B. TOPIC: Stability of critical points

C. SUBTOPIC: Stability of critical points of the non linear differential equation non linear

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Reviewing the previously material	Paying attentions, noting	White board and OHP,
PRESENTATION	- describing Stability of critical points of the non linear differential equation non linear - giving examples	Paying attentions, listening and noting	White board, OHP
CLOSING	- asking for and giving an assignment	Discussing and doing	White board, OHP

E. EVALUATION: assignments and questions and answers to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

TEACHING PROGRAM UNIT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 217
CREDIT : 3
MEETING TIME : 150 minutes
MEETING : 14th

A. INSTRUCTIONAL OBJECTIVES:

1. GENERAL: After the course, students are able to solve exercises final test
2. SPECIFIC: After the course, students are able to solve exercises from meeting 7th until 13th

B. TOPIC: Evaluation stages second

C. SUBTOPIC: exercises in final test

D. TEACHING-LEARNING ACTIVITIES

STAGES	LECTURER ACTIVITIES	STUDENTS ACTIVITIES	MEDIA
INTRODUCTION	Announcement for testing	Paying attentions and listening	White board
PRESENTATION	- distributing paper sheets - giving exercises	Paying attentions and preparing themselves	White board
CLOSING	- asking for and giving an assignment	Discussing and doing	White board

E. EVALUATION: giving test to know how far the effectiveness of the teaching program

F. REFERENCES:

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd New Delhi

LEARNING CONTRACT

COURSE TITLE : THEORY OF DIFFERENTIAL EQUATION
COURSE CODE : MAT 109
CREDIT : 3

I. INSTRUCTIONAL OBJECTIVES AND COURSE TITLE BENEFIT

Mathematics as one science to solve the problems expressed in differential equation. Theory of differential equation is branch mathematics consist of some concepts and theorems which describe the existence and uniqueness of solution of the system differential equation and its qualitative solution. The course is offered to be known and used to solve the real world problems especially in ecology and physics field.

II. LEARNING DESCRIPTION

The course is as fundamental theory, which describes the solution behavior of differential equation. The course describes the nature and solution of the differential equation. The course is as basic to develop the dynamics system which explains a physics phenomenon. This physics phenomenon can be analyzed from solution of the differential equation system and through stability analysis of solution and critical points.

III. INSTRUCTIONAL OBJECTIVES

a. General Instructional Objective

After finishing the course, the students are expected to able to describe, solve and analyze behavior some differential equation and differential equation system. In addition, the students are able to interpret how the dynamics behavior of differential equation and differential equation system

b. Specific Instructional Objective

The students are able to:

- describe concerning with solution of differential equation and differential equation system.
- solve concerning with behavior of differential equation and differential equation system.
- analyze the analytical behavior of differential equation and differential equation system

IV. LEARNING STRATEGY

- Learning method consist of discourse, discussion, and exercises
- Time estimation 150 minutes consist of:
 - 90 minutes is to explain about topic
 - 30 minutes is to deliver some examples of problem and solving
 - 30 minutes is to solve exercises and discussion
- Students total more or less 50 persons
- + each of group consist of 5-7 persons
- + Topics
 1. Lipschitz condition
 2. existence solution
 3. uniqueness solution

V. REFERENCES

1. Sheply L. Ross, Differential Equations, 1984, John Wiley & Sons Inc.
2. Earl A. Coddington, Norman Levinson, 1980, Tata Mc Graw-Hill, Publ.Co.Ltd, New Delhi.

VI. ASSIGNMENTS

- Doing home work or assignments given for individual and teams after course

VII. ASSESSMENT

Assessment criterion as follows:

1. Score A : 4
2. Score AB : 3,5
3. Score B : 3

- 4. Score BC : 2,5
- 5. Score C : 2
- 6. Score CD : 1,5
- 7. Score D : 1
- 8. Score E : 0

To determine final score using weight as follows:

- 1. Assignments : 20 %
- 2. EVALUATION of middle test : 40%
- 3. EVALUATION of final semester : 40 %

VIII. Jadwal perkuliahan

Meeting	TOPIC	REFERENCES
1	Concepts of real function sequences, convergence, M-test Weiertrass theorem	1
2	Concepts of continuity of two variables function, Lipschitz condition	1, 2
3	Fundamental theorem of existence of solution of first order differential equation	1, 2
4	Fundamental theorem of existence and uniqueness of solution of first order differential equation	1, 2
5	Existence and uniqueness of solution in open and unbounded interval	1, 2
6	Solution of differential equation with initial condition, solution uniqueness depend on initial condition	1, 2
7	Solution and uniqueness depend on function	1, 2
8	Existence and uniqueness of second order differential equation	1, 2
9	Understanding and way to depict in phase plane	1, 2
10	Definition and understanding of critical points.	1, 2
11	Types of critical points	1,2
12	Definition of stability of critical points	1, 2
13	Stability analysis of critical points of non linear differential equation.	1, 2
14	Final Test	1, 2

OUTLINE OF TEACHING PROGRAM

Course Title : Theory of Differential Equation (TPE)

Course Code/Credit : PAM 413 / 3

Description : Mathematics as one science to solve the problems expressed in differential equation. Theory of differential equation is branch mathematics consist of some concepts and theorems which describe the existence and uniqueness of solution of the system differential equation and its qualitative solution. The course is offered to be known and used to solve the real world problems especially in ecology and physics field.

General Instructional Objective:

After finishing the course, the students are expected to able to describe, solve and analyze behavior some differential equation and differential equation system. In addition, the students are able to interpret how the dynamics behavior of differential equation and differential equation system

No	Specific Instructional Objectives	Topic	Sub Topics	Time	References
1	By explaining the subject and learning contract, the students will be expected to be able to understand the substantial of lecturing and the low of lecturing activity	Introduction: Description Course description and low of lecturing	Description the subject and relationship with others course and its applications	150 minutes	Teaching Program Unit, Learning Program Outline Lecturing Contract
2	Students are able to Concepts of real function sequences, convergence	Real function sequences convergence	Concepts of real function sequences, convergence, M-test Weiertrass theorem	150 minutes	[1], [2]

3	Students are able to explain the concepts of continuity of two variables function, Lipschitz condition	continuity of two variables function	Concepts of continuity of two variables function, Lipschitz condition	150 minutes	[1], [2]
4	Students be able to describe the fundamental theorem of existence of solution of first order differential equation	Theorem of existence of solution of	Fundamental theorem of existence of solution of first order differential equation	150 minutes	[1], [2]
5	Students are able to describe the understanding of the fundamental theorem of existence and uniqueness of solution of first order differential equation.	Existence and uniqueness of solution	Fundamental theorem of existence and uniqueness of solution of first order differential equation	150 minutes	[1], [2]
6	Students are able to explain the existence and uniqueness of solution in open and unbounded interval	Existence and uniqueness of solution	Existence and uniqueness of solution in open and unbounded interval	150 minutes	[1], [2]
7	Students are able to explain solution of differential equation with initial condition, solution uniqueness depend on initial condition	Solution of differential equation	Solution of differential equation with initial condition		
8	Students are able to explain the existence and uniqueness of solution depend on function	Existence and uniqueness of solution	Existence and uniqueness of solution depend on function	100 minutes	
9	The students are able to explain the existence and uniqueness of second order differential equation.	Existence and uniqueness	Existence and uniqueness of second order differential equation	150 minutes	[1], [2]
10	The students are able to describe the way to depict a system in phase plane	phase plane	Understanding and way to depict in	150 minutes	[1], [2]

			phase plane		
11	The students understand definition and understanding of critical points.	critical points	Definition and understanding of critical points.	150 minutes	[1], [2]
12	The students understand and be able to analyze the stability of critical points	Stability of critical points	Definition and understanding of stability of critical points	150 minutes	[1], [2]
13	The students understand and be able to analyze the stability of critical points of non linear differential equation	Stability analysis	Stability analysis of critical points of non linear differential equation	150 minutes	[1], [2]
14	The students are able to solve exercises and final test	Final test	Final test	100 minutes	[1], [2]

References:

1. Boyce, W.E, Richard C.DiPrima, *Elementary Differential Equations and Boundary Value Problems*, fifth edition, John Wiley & Sons, Inc, New York, 1992
2. Haberman, R., *Elementary Applied Partial Differential Equations: with fourier series and baoundary value problems*, Second Edition, Prentce-Hall International Editions, Singapore 1987.
3. Kartono, *Maple untu Persamaan Diferensial*, edisi 2, Graha Ilmu, Yogyakarta, 2005