

**LEARNING PROGRAM OUTLINE
LEARNING UNIT PROGRAM**

GRAPH THEORY

COURSE CODE: PAM 107

3 SCU

SEMESTER VI



BY:

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FACULTY OF MATHEMATIC AND NATURAL SCIENCES
DIPONEGORO UNIVERSITY
SEMARANG**

UPT-PUSTAK-UNDIP
No. Daft: 0230/BA/PMIPA/e ₁
Tgl. : 27-7-'09

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 1st and 2nd

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC : After coursing, the students to be able to definition graphs.

B. TOPIC : Definition of a Graphs.

C. SUB TOPIC : Introductions, Definition of Graphs, Isomorphic Graphs, Graphs, Cards Graphs.

D. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">Explaining the material to reach the goal at meeting of 1st and 2nd.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">Explaining what is a graphs.Explaining definitions graphs, multiple edges, simple graph, connected, disconnected and sugraph.Giving examples.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">Giving comment of work of students.Giving assignment for self supporting.Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.

Wilson, R.J. and John Watkins; 1990 ; Graph: An Introductory Approach.; John Wiley & Sons.Inc.

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 3th

A. INSTRUCTIONAL GOAL.

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC : After coursing, the students can explain the standart terminology in graphs and can give some examples.

B. TOPIC : Definition and examples in Graphs.

C. SUB TOPIC : Adjacency and incidence, Path and Cycle, Some examples of graphs and its terminology.

E. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">▪ Explaining the material to reach the goal at meeting of 3th.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">▪ Explaining definition adjacent and incident of graphs.▪ Explaining definitions walk, closed walk, path and cycle.▪ Explaining definitions complete graph, null graph, cycle graph, path graph and bipartite graphcycle.▪ Giving examples.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">▪ Giving comment of work of students.▪ Giving assignment for self supporting.▪ Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.
Frank Harary; 1972 ; Graph Theory. Addison Wesley
Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.

Wilson. R.L and John Watkins: 1990 : Graph: An Introductory Approach .

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 4th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC : After coursing, the students can explain and give brief descriptions of several areas with graphs have been found usefull, like chemistry, sociology and hierarki trees.

B. TOPIC : Applications of graphs and some examples.

C. SUB TOPIC : Application of graphs in chemistry, social sciences, trees.

F. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">▪ Explaining the material to reach the goal at meeting of 4th.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">▪ Explaining appication of graphs in chemestryand some examples.▪ Explaining appication of graphs in social sciencesand some examples.▪ Explaining definitions tree and some examples.▪ Giving some exercise to do the student	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">▪ Giving comment of work of students.▪ Giving assignment for self supporting.▪ Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.

Wilson. R.J. and John Watkins: 1990 : Graph: An Introductory Approach .

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 5th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC : After coursing, the students to be able to understand and explain definition of directed graphs.

B. TOPIC : Directed Graphs.

C. SUB TOPIC : Introductions, Definition of Directed graphs, Adjacency and Incidence, Path and Cycle.

G. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	▪ Explaining the material to reach the goal at meeting of 5th.	Listening and Noting.	OHP
PRESENTATION	▪ Explaining the difference of graphs and directed graphs. ▪ Explaining definitions directed graphs and some examples. ▪ Explaining definitions adjacency and incidence. ▪ Explain and give some examples of path and cycle in directed graphs ▪ Giving some exercise	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	▪ Giving comment of work of students. ▪ Giving assignment for self supporting. ▪ Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.
Frank Harary; 1972 ; Graph Theory. Addison Wesley
Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 6th and 7th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC : After coursing, the students to be able to explain and application definition of directed graphs of several areas.

B. TOPIC : Application of Directed Graphs.

C. SUB TOPIC : Signed Digraphs, Finite State Machines, Signal Flow Graphs.

H. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">Explaining the material to reach the goal at meeting of 6th and 7th.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">Explaining definitions signed directed graphs and giving some examples.Explaining definitions finite state machine of digraphs and giving some examples.Explain and give some examples of signal flow graphs.Giving some exercise to do the student	Listening, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">Giving comment of work of students.Giving assignment for self supporting.Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 8th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

2. SPECIFIC :1. Students can explain definition and properties of Eulerian Graphs and Eulerian Digrap.
2. Students can give examples of Eulerian Graphs and Digraphs type problems.

B. TOPIC : Eulerian Graphs dan Digraphs.

C. SUB TOPIC : Definition of eulerian graphs and digraphs, type problems eulerian graphs and its solution.

I. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	▪ Explaining the material to reach the goal at meeting of 8 th .	Listening and Noting.	OHP
PRESENTATION	▪ Explaining definitions, properties eulerian graphs and type problem of eulerian graphs. ▪ Explaining definitions, properties eulerian digraphs and type problem of eulerian digraphs. ▪ Giving examples.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	▪ Giving comment of work of students. ▪ Giving assignment for self supporting. ▪ Giving description about next meeting.	Doing and discussing	Whiteboard and Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 9th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

3. SPECIFIC :1. Students can explain definition and properties of Hamiltonian Graphs and Hamiltonian Digrap.
2. Students can give examples of Hamiltonian Graphs and Digraphs type problems.

B. TOPIC : Hamiltonian Graphs dan Digraphs.

C. SUB TOPIC : Definition of hamiltonian graphs and digraphs, type problems hamiltonian graphs and its solution.

J. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">Explaining the material to reach the goal at meeting of 9th.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">Explaining definitions, properties hamiltonian graphs and type problem of hamiltonian graphs.Explaining definitions, properties eulerian digraphs and type problem of hamiltonian digraphs.Giving examples.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">Giving comment of work of students.Giving assignment for self supporting.Giving description about next meeting.	Doing and Discussing	Whiteboard, Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 10th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

4. SPECIFIC :1. Students to be able to understand the shortest path algorithm, the longest path algorithm.
2. Students can use this algorithm to find the shortest and longest path.

B. TOPIC : Path Algoritn.

C. SUB TOPIC : The shortest path algorithm and the longest path algorithm.

K. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	▪ Explaining the material to reach the goal at meeting of 10 th .	Listening and Noting.	OHP, transparansi,
PRESENTATION	▪ Explaining the shortest path algorithm and giving example to use this algorithm to find the shortest path. ▪ Explaining the longest path algorithm and giving example to use this algorithm to find the longest path. ▪ Explaining application the shortest algorithm and the longest algorithm in real problem.	Listenig, Noting, Discussing and doing examples	OHP, transparansi, papan tulis Papan tulis
CONCLUSION	▪ Giving comment of work of students. ▪ Giving assignment for self supporting. ▪ Giving description about next meeting.	Menanggapi Diskusi Mencatat Mencatat Memperhatikan	Papan tulis Kertas Kertas

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia
Pustaka Utama, Jakarta.

Wilson, R.J. and John Watkins; 1990 ; Graph: An Introductory Approach.;
John Wiley & Sons, Inc.

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 11th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

5. SPECIFIC :1. Students can explain definition and properties edge connectivity, vertex connectivity, Menger's Theorem for Graphs and Digraphs.

2. Students can give examples of edge connectivity, vertex connectivity and application of Menger's Theorem.

B. TOPIC : Connectivity Graphs dan Digraphs.

C. SUB TOPIC : Edge connectivity, Vertex connectivity, Menger's Theorem for Graphs and Digraphs.

L. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	▪ Explaining the material to reach the goal at meeting of 11 th .	Listening and Noting.	OHP
PRESENTATION	▪ Explaining definitions, properties edge connectivity, vertex connectivity, Menger's Theorem for graphs. ▪ Explaining definitions, properties edge connectivity, vertex connectivity, Menger's Theorem for digraphs. ▪ Giving examples ▪ Students do the exercise.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	▪ Giving comment of work of students. ▪ Giving assignment for self supporting. ▪ Giving description about next meeting.	Doing and Discussing	Whiteboard, Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia

TEACHING PROGRAM UNIT

SUBJECT : GRAPH THEORY
 CODE / SKS : MAT 333 / 3 SKS
 MEETING TIME : 150 minutes
 MEETING : 12th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

6. SPECIFIC :1. Students can explain definition and properties of Trees and Spanning Trees, Centers and Bicenters.
 2. Students can explain how to Counting Trees, Searching Trees, Constructing Trees.

B. TOPIC : Trees.

C. SUB TOPIC : Trees, Properties of Trees, Spanning Trees, Counting Trees, Searching Trees, Constructing Trees.

M. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none"> ▪ Explaining the material to reach the goal at meeting of 12th. 	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none"> ▪ Explaining definitions, properties of trees, spanning trees, centers and bicenters. ▪ Explaining how to counting trees, searching trees and constructing trees. ▪ Giving examples trees, spanning trees and this applications in real problem. ▪ Students do the exercise. 	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none"> ▪ Giving comment of work of students. ▪ Giving assignment for self supporting. ▪ Giving description about next meeting. 	Doing and Discussing	Whiteboard, Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

F. REFERENSI : Chartrand Gary, Oellermann O.R.; 1993 ; Applied and Algorithms Graph Theory, M.C. Graw Hill, Inc.

Frank Harary; 1972 ; Graph Theory. Addison Wesley

Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia

SUBJECT : GRAPH THEORY

CODE / SKS : MAT 333 / 3 SKS

MEETING TIME : 150 minutes

MEETING : 13th

A. INSTRUCTIONAL GOAL

1. GENERAL : After coursing, the students to be able to understand definition, properties and application of graph and digraph in real problem. digraph.

7. SPECIFIC :1. Students can explain definition and properties of Planar Graphs.
2. Students can explain how to testing for Planarity and this application.

B. TOPIC : Planar Graphs.

C. SUB TOPIC : Definition of planar graphs, testing for planarity, duality.

N. ACTIVITY

STEP	LECTURE ACTIVITY	STUDENT ACTIVITIES	MEDIA AND TOOLS
INTRODUCTION	<ul style="list-style-type: none">Explaining the material to reach the goal at meeting of 9th.	Listening and Noting.	OHP
PRESENTATION	<ul style="list-style-type: none">Explaining definitions, properties planar graphs.Explaining how to testing for planarity.Giving examples.	Listenig, Noting, Discussing and doing examples	OHP, whiteboard
CONCLUSION	<ul style="list-style-type: none">Giving comment of work of students.Giving assignment for self supporting.Giving description about next meeting.	Doing and Discussing	Whiteboard, Paper

E. EVALUATION : Giving problems as practice at home to evaluation what the material was understood.

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Frank Harary; 1972 ; Graph Theory. Addison Wesley
Liu C.I.; 1995 ; Dasar-dasar Matematika Diskrit, Penerbit PT. Gramedia Pustaka Utama, Jakarta.