Philadelphia University	PHILADELPHIA UNIVERSITY THE WAY TO THE FUTURE	**Approval date:**
Faculty of Science		**Issue:**
Department Mathematics		**Credit hours 3**
Academic year 2023/2024	**Course Syllabus**	**Bachelor**

Course Information

Course#	Course title	Prerequisite
0250251	**Graph Theory**	**0250241**

Course type	Class time	Room
☐ University Requirement ☐ Faculty Requirement ☒ Major Requirement ☐ Elective ☐ Compulsory	**Sat-Mon 12:40-13:30** **Sun-Wed 9:45-10:35**	**6606** **21005**

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Dr. Hani Kawariq	**2824**	**2264**	**S/T/M/W 11:15-12:15**	**hkawariq@philadelphia.edu.jo**

Course Delivery Method

Course Delivery Method			
☐ **Physical**	☐ **Online**	☒ **Blended**	
Learning Model			
Percentage	**Synchronous**	**Asynchronous**	**Physical**
	0%	**33%**	**67%**

Course Description

This course is an introduction to Graph Theory and its applications, covering topics in Graph isomorphism, Trees and its applications, Bipartite Graphs and Matching, Euler and Hamiltonian Graphs, Graph Coloring, Planar Graphs, Metrical Representations, Digraphs and Networks, with numerous graph algorithms throughout.

Course Learning Outcomes

Number	Learning Outcomes	Corresponding Program Outcomes
Knowledge		
K1	Analyze the regularity of some graph. Determine whether or not a sequence is graphical. Determine the Isomorphism between two graphs. Produces a spanning tree of a graph. Produce a minimal spanning tree a graph. The concept of the isomorphism a weighted graph G.	**Kp1**
K2	Understand the concepts of Walk, Euler Walks, Cycles, Hamilton Cycles. Find the distance between the vertices. Find the shortest closed walk. Find the adjacency, and incidence matrices. Find the distance matrix.	**Kp2**
K3	Coloring bipartite graphs. Determine when the graph is planar. Determine the Chromatic number. Understand the Regions of a plane graph. Know the Maps and the dual graphs.	**Kp2**
Skills		
S1	Understand mathematical definitions and demonstrate it in different graphs and writing algorithms.	**Sp1**
Competencies		
C1	Express thoughts in good logical writing (Examples, Proofs, …etc)	**Cp1**

Learning Resources

Course textbook	Amin Witno, Discrete Structures in five chapters.
Supporting References	1. **Lecture Notes based on Amin Witno Book.** 2. **A Friendly Introduction to Graph Theory, by Fred Buckley , Marty Lewinter .** 3. **Introductory to Graph Theory, by Fred Buckley , Marty Lewinter .**
Supporting websites	http://www.witno.com/philadelphia/courses.htm
Teaching Environment	☒**Classroom** ☐ **laboratory** ☒**Learning platform** ☐**Other**

Meetings and subjects timetable

Week	Topic	Learning Methods	Tasks	Learning Material
1	**Introduction to the uses of Graphs, basic definitions, with special properties, Degree Sequence of a graph**	**Lecture**		**Suggested Questions for Practice**

				From Lecture Notes Chapter # 1
2	Isomorphism of graphs, subgraphs, self-complementary graphs, connected graphs and bridges.	Lecture	Assignment #1	Chapter # 1
3	Adjacency matrix, permutation matrix, incidence matrix, degree matrix.	Lecture		Chapter # 1
4	Trees and acyclic graphs, spanning trees, the matrix tree theorem.	Lecture	Quiz 1	Chapter # 2
5	Weight matrix, Kruskal's and Prim's algorithms for minimal spanning tree, depth-first and breadth-first search.	Lecture		Chapter # 2
6	Walks in a graph, counting triangles subgraphs, distance and diameters.	Lecture	Midterm Exam	Chapter # 3
7	Distance matrix, distance in weighted graphs, Dijkstra's algorithm	Lecture		Chapter # 3
8	Euler walk and Euler circuit, the Chinese postman problem	Lecture		Chapter # 3
9	Hamilton cycles and Hamiltonian graphs, the traveling salesman problem and solutions for special cases.	Lecture	Assignment # 2	Chapter # 4
10	Bipartite graphs and its coloring algorithm, complete and perfect matching, Hall's theorem.	Lecture		Chapter # 4
11	Chromatic number, sequential coloring algorithm, Welsh-Powell coloring algorithm.	Lecture		Chapter # 4
12	Planar graphs, proving planarity using Hamilton cycles.	Lecture	Quiz 2	Chapter # 4
13	Regions of a plane graph, Euler's formula and planarity tests, homeomorphism and Kuratowski's theorem.	Lecture		Chapter # 4
14-15	Maps and the dual graphs, the four-color theorem and proofs of the six and five-color theorems.	Lecture		Chapter # 4
16	Final Exam			

* includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

Using Technology
Communication skills
Improve the communication skills of the student by giving oral quizzes and discuss the assignments at the class

Application of concepts learnt

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	30%	Week 6-8	**K1,S1**
Various Assessments *	30%	Continous	**All of them**
Final Exam	40%	Week 16	**All of them**
Total	100%		

* includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
	Knowledge		
K1	Analyze the regularity of some graph. Determine whether or not a sequence is graphical. Determine the Isomorphism between two graphs. Produces a spanning tree of a graph. Produce a minimal spanning tree a graph. The concept of the isomorphism a weighted graph G.	Lecture	**Exam,Assignment**
K2	Understand the concepts of Walk, Euler Walks, Cycles, Hamilton Cycles. Find the distance between the vertices. Find the shortest closed walk. Find the adjacency, and incidence matrices. Find the distance matrix.	Lecture	**Exam, Quiz**
K3	Coloring bipartite graphs. Determine when the graph is planar. Determine the Chromatic number. Understand the Regions of a plane graph. Know the Maps and the dual graphs.	Lecture	**Exam, Quiz**
	Skills		
S1	Understand mathematical definitions and demonstrate it in different graphs and writing algorithms.	Lecture	**Exam,Quiz**
	Competencies		
C1	Express thoughts in good logical writing (Examples, Proofs, …etc)	Problem Solving	**Assignment**

* includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

** includes: quiz, in class and out of class assignment, presentations, reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	• Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from the exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and seven lectures (S,T,R). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.

Program Learning Outcomes to be assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Target Performance level
Kp1	Analyze the regularity of some graph. Determine whether or not a sequence is graphical. Determine the Isomorphism between two graphs. Produces a spanning tree of a graph. Produce a minimal spanning tree a graph. The concept of the isomorphism a weighted graph G.		**Lectures, Assignments, Exams, Quizes**	
Kp2	Understand the concepts of Walk, Euler Walks, Cycles, Hamilton Cycles. Find the distance between the vertices. Find the shortest closed walk. Find the adjacency, and incidence matrices. Find the distance matrix. Coloring bipartite graphs. Determine when the graph is planar. Determine the Chromatic number. Understand the Regions of a plane graph. Know the Maps and the dual graphs.		**Lectures, Assignments, Exams, Quizes**	
Sp1	Understand mathematical definitions and demonstrate it in different graphs and writing algorithms.		**Lectures, Assignments, Exams, Quizes**	

Cp1	Express thoughts in good logical writing (Examples, Proofs, …etc)		**Lectures, Assignments, Exams, Quizes**	

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
Kp1	Short quizzes mainly (1) with 10 points each
Kp2	Short quizzes mainly (3) with 10 points each
Sp1	**Quiz, Exam**
Cp1	**Assignment**

Assessment Rubric of the Program Learning Outcome
