STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

MATH 371 – GRAPH THEORY

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Canino School of Engineering Technology

Mathematics Department

Spring 2019

A. **TITLE**: **Graph Theory**

B. **COURSE NUMBER: Math 371**

C. **CREDIT HOURS: 3 credit hour(s) per week for 15 weeks**

D. **WRITING INTENSIVE COURSE**: No

E. **GER CATEGORY: None:**

F. **SEMESTER(S) OFFERED: Spring**

G. **COURSE DESCRIPTION:**

This course is an introduction to the basic concepts of graph theory. Common classes of graphs such as paths, trees and cycles are analyzed. We will consider isomorphism, connectivity, and traversability. If time permits, planarity and graph colorings may be considered. Applications are given to chemistry, engineering and computer science.

H. **PRE-REQUISITES:** Calculus II (MATH 162) or permission of the instructor.

CO-REQUISITES: None

I. STUDENT LEARNING OUTCOMES:

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***		
1. Recognize different classes of graphs. Such as: connected graphs, regular graphs, complete graphs, trees, multigraphs, digraphs and Eulerian & Hamiltonian graphs.			3	Foundational Skills	QTR
2. Perform operations on graphs, such as: union, intersection, join, Cartesian-product, and complement.			3	Foundational Skills	QTR
3. Determine the degree sequence of a graph, then use the Havel-Hakimi Theorem to identify if the sequence is graphical.			3	Foundational Skills	QTR
4. Determine if two graphs are isomorphic.			3	Foundational Skills	QTR
5. Use the Matrix Tree Theorem to determine the number of spanning trees in a graph.			3	Foundational Skills	QTR
6. Identify cut vertices and bridges of connected graphs, compute the (edge and vertex) connectivity of a graph			3	Foundational Skills	QTR
7. Use the appropriate method of proof in understanding and proving theorems.			3	Foundational Skills	QTR

J. APPLIED LEARNING COMPONENT: No

K. TEXTS: Introduction to Graph Theory, Chartrand/Zheng, McGraw-Hill Higher Education, First Edition (2005).

A computer software program (such as Maple) will be used when appropriate.

L. REFERENCES: N/A

M. EQUIPMENT: Smart classroom (Computer projection and access to the Internet)

N. GRADING METHOD: A - F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- Quizzes
- Exams
- Project
- Homework
- Participation

P. DETAILED COURSE OUTLINE:

I. Introduction
   - A. Graphs and Graph Models
   - B. Connected Graphs
   - C. Common Classes of Graphs
   - D. Operations on Graphs
     - a. Union
     - b. Intersection
     - c. Join
     - d. Cartesian Product
     - e. Complement
   - E. Multigraphs and Digraphs

II. Degrees
   - A. The Degree of a Vertex
   - B. Regular Graphs
   - C. Degree Sequences
   - D. Havel-Hakimi Theorem
   - E. Graphs and Matrices
   - F. Irregular Graphs (The Party Theorem)

III. Isomorphic Graphs
   - A. The Definition of Isomorphism
   - B. Isomorphism as a Relation

IV. Trees
   A. Bridges
   B. Trees
   C. The Minimum Spanning Tree Problem
   D. The Number of Spanning Trees (Matrix Tree Theorem)

V. Connectivity
   A. Cut-Vertices
   B. Blocks
   C. Connectivity

VI. Traversability
   A. Eulerian Graphs
   B. Hamiltonian Graphs
   C. Hamiltonian Walks

VII. Methods of Proof
   A. Direct Proof
   B. Counterexamples
   C. Proof by Contrapositive
   D. Proof by Contradiction
   E. Proof by Induction

VIII. Planarity (Optional)
   A. Planar Graphs
   B. Embedding Graphs on Surfaces
   C. Graph Minors

IX. Coloring Graphs (Optional)
   A. The Four-Color Problem
   B. Vertex Coloring
   C. Edge Coloring

Q. <u>LABORATORY OUTLINE</u>: None