COURSE TITLE:

GRAPH THEORY

INSTRUCTOR:

Professor Stefanos Spartalis

SYLLABUS:

Introduction to Graphs and Graph theory

Basic concepts and mathematical definitions. Introduction to graphs - standard definition. Isomorphisms of Graphs. Representations of Graphs (adjacency matrix, incidence matrix, edge lists). Graphical sequence - Algorithm of graphical sequence. Graph Construction Operations in Graphs and properties (union-intersection-ring sum-coalescence-interchange-sum). Special (basic) Graphs - Complete Graph - Complementary Graph – Sub graph.

Directed Graphs

Connectivity (Menger's Theorem)

Walk - Paths – cycles

Hamilton's Theorems (Walks - paths - cycles)

Euler's Theorems (Walks - paths - cycles)

Trees

Definitions - theorems - properties – examples. Directed Trees - Binary Trees. Traversal (Algorithm - example). Spanning Trees. Representation of discrete structures in real world with examples of tree structures, examples of trees.

Planarity

Plane and Planar Graphs. Definitions. Euler's Theorem - Euler's Formula. Solid polyhedra. Kuratowski´s Theorem. Minor Graphs Theory.

Graph Coloring

Definitions. The Five Color Theorem. The Four Color theorem. Examples and exercises with graphs.

The Chinese postman problem and its applications in the modern world

The traveling salesman problem and its applications in the modern world

Applications of Graph Theory in Industrial Production

Examples of using Graph Theory Applications in Industrial Production (the production process - sequence of operations - minimize the total time of the machine - solving methods using directed graphs - Euler's and Hamilton's theorems).

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2. Γιάννης Μανωλόπουλος, Μαθήματα Θεωρίας Γράφων: Θεμελιώσεις – Αλγόριθμοι – Εφαρμογές. Εκδόσεις Νέων Τεχνολογιών, ISBN 960-7235-87-8, Έκδοση 2η (2000).
3. Παναγιώτης Γ. Σπύρου , Θεωρία Γραφημάτων , Πανεπιστήμιο Αθηνών, Τμήμα Μαθηματικών , Αθήνα 1997 (πανεπιστημιακή έκδοση)
4. Μάριος Μαυρονικόλας , Διακριτά Μαθηματικά και Μαθηματική λογική, τόμος Β ,Θεωρία Γράφων , ISBN : 960 538-461-2
5. Reinhard Diestel , Graph Theory ,Electronic Edition 2005 ,Springer- Verlag Heidelberg ,New York 1997,2000,2005
6. J.A.Bondy , U.S.R. Murty . Graph Theory with Applications , Electronic Edition , ISBN 0-444-19451-7