**University of Management and Technology**

**Course Outline**

MTH737-Advance Fuzzy Graphs with Applications

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| Program | PhD Math |
| Credit Hours | 3 |
| Duration |  |
| Prerequisites |  |
| Resource Person | Dr. Tabasam Rashid |
| Counseling Timing  (Room# ) |  |
| Contact: |  |

**Learning Objective:**

* Demonstrate knowledge of the syllabus material;
* Write precise and accurate mathematical definitions of objects in fuzzy graph theory;
* Validate and critically assess a mathematical proof;
* Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in Fuzzy graph theory;
* Reason from definitions to construct mathematical proofs;
* Use of fuzzy graph theory in several applications especially in daily life decision making problems.

**Learning Methodology:**

There will be three components to the course activities.

1. *Study of the course text:*  
   Course book is freely available online. Students are expected to engage in independent study of this text or at least in certain prescribed sections of it. Consultation of other books on fuzzy graph theory is also encouraged.
2. *Seminar Series*:
   * key concepts from the text and questions arising;
   * investigation of questions posed for seminar discussion;
   * Occasional presentation by students of key items from the syllabus;
   * Strategies for thinking about fuzzy graph theory and about mathematics generally;
   * Proofs in fuzzy graph theory;
3. *Working on Assigned Tasks:*   
   The course will include at least four sets of assigned tasks. These tasks will include some very specific problems to solve and also some more open-ended topics to investigate. They will also include presentations of specific topics to the class.

**Recommended Text Books:**

Advanced Topics in Fuzzy Graph Theory (**Mordeson**, John, **Mathew**, Sunil) 2019, Springer International Publishing

**Reference Books:**

Fuzzy Graph Theory (**Mathew**, Sunil, **Mordeson**, John N., **Malik**, Davender S.) 2018, Springer International Publishing

Fuzzy Graphs and Fuzzy Hypergraphs (John N. Mordeson and Premchand S. Nair) 2000, Phisica-Verlag Heidlberg New York.

**Calendar of Course contents to be covered during semester**

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| --- | --- |
| **Week** | **Course Contents** |
| 1 | Introduction to Fuzzy Logic,  Fuzzy Sets, Multi Sets  Fuzzy Relations,  Fuzzy Equivalence Relations |
| 2 | Pattern Classification  Similarity Relations |
| 3 | Fuzzy Graphs, Fuzzy Hypergraphs  Paths and Connectedness  Bridges and Cut Vertices  Forests and Trees |
| 4 | A characterization of Fuzzy Trees  Fuzzy Cut sets  Fuzzy Chords,  Fuzzy Cycle Set |
| 5 | Fuzzy Line Graph  Complement of Fuzzy Graphs  Hand Shaking Lemma |
| 6 | Fuzzy Interval Graphs  Fuzzy Intersection Graphs  Degree, size , order in Fuzzy Graphs |
| 7 | Gilmore and Hoffman Characterization  Distance, Diameter in Fuzzy Graphs |
| 8 | Operations on Fuzzy Graphs  Cartesian Product and Composition |
| 9 | Union and Join  Fuzzy Tree |
| 10 | Clusters  Cluster Analysis  Cohesiveness  Slicing in Fuzzy Graphs |
| 11 | Application to Cluster Analysis |
| 12 | Fuzzy Intersection Equations  Existence of Solutions |
| 13 | Representation of Dependency Structure  Connectedness Criteria  Inclusive Connectedness Categories  Exclusive Connectedness Categories |
| 14 | Fuzzy Hypergraphs  Coloring of Fuzzy Hypergraphs |
| 15 | Hebbian Structures  Additional Applications |