

# MATH6995.001 - Algebraic Graph Theory

Preliminary Syllabus (Fall 2010 Graduate Course)

**Instructor:** Dr. Xuerong Yong, Email: xryong@math.uprm.edu, Tel: 787-832-4040 ext. 5871.  
**Office:** M407G. **Office Hours:** Mondays: 4:30 - 6:30 pm in Room 407G.

- **Main Reference Books:**

- (1) D. Cvetkovic, M. Doob and H. Sachs, Spectra of Graphs, Johann Ambrosius Barth, Third Edition, 1995.
- (2) N. Biggs, Algebraic Graph Theory, Cambridge University Press, Second Edition, 1993.

- **Objectives:** Introduction to the general issues of algebraic graph theory, the spectral techniques; enumerations of the structures such as the independent sets, matchings, spanning trees, Hamiltonian cycles, etc..

- **Credit Number:** 3

- **Prerequisites:** Linear Algebra, Elements of Graph Theory

- **Expected Work:** Four Written Homework ( $= 1/3$ ); Midterm+Final ( $= 2/3$ ).

- **Covering Topics:**

1. *Fundamental Concepts* : independent sets, matchings, spanning trees, Hamiltonian cycles, Eulerian orientations, cycle covers, etc..
2. *Operations on Graphs and the Resulting Spectra*: the polynomial of a graph, eigenvalues and eigenvectors, line graphs and total graphs. etc..
3. *The Divisor of Graphs*: The divisor and cover, symmetry properties, some generalizations
4. *Spectral Characterizations*: Eigenvalues of L-, Q-, and adjacency matrix, co-spectral graphs, graphs characterized by their spectra;
5. *Spectral Techniques in Graph Theory and Combinatorics*: Computing the structures such as, independent sets, matchings, spanning trees, Hamiltonian cycles, Eulerian orientations, etc..
6. *Additional Topics*: Random Graphs, Ramsey Theory, Extremal Problems

- **Other References:**

1. "Modern Graph Theory" by Bela Boobas, Springer, 1998.
2. "Graph Theory" by Reinhard Diestel, Third Edition, Springer, 2005