One of the purposes of this course is to show that what is driving the field of applied mathematics around the turn of this 21st century is the Internet. This course will basically review the new mathematical endeavors that have emerged out of the information society; in particular, the “dark side” of the information society, that is, the great many attack schemes it is subject to and, on the positive side, the science of making the Internet robust against attacks, sometimes referred to as “information warfare.”

The course will roughly be broken down in two parts—one devoted to advanced graph theory (random graphs, hyperbolic graphs) and the other devoted to modeling Internet signals in the nonGaussian setup. Somewhere between the two parts, we will talk about worm propagation on graphs.

**Synopsis of the course**


2. **Worm propagation on graphs.** Probabilistic modeling of worm propagation. Worm propagation on random graphs, on heavy tailed graphs, and on Cayley graphs. Dependence of the speed of propagation of the worm on the topology of the graph. Countermeasures to curve the speed of propagation of the worm.

3. **Modeling of traffic signal.** Introduction to non-Gaussian signal modeling. Non-Gaussian stable distributions. Burstyness, self-similarity. Chaotic analysis of traffic signals. Linear and nonlinear canonical correlation analyses. Alternating Conditional Expectation (ACE). Linear and nonlinear baseline traffic models. Utilization of baseline traffic model to detect CBR, SYN, etc. attacks. (To be more specific, should be baseline model no longer fit the data, some attack must be under way.)
**Format**
The course will be presented as an advanced research of the “seminar type.” The topics to be covered will roughly follow the above outline, but the course content is meant to be flexible, depending on students’ interests and level of preparation and on the swift evolution of the field. Active participation of students is encouraged and expected. Each student will have to prepare a term project relevant to the course material, of the student’s choice, but subject to instructor’s approval.

**Prerequisites**
Some knowledge of networking is expected (e.g., EE450). The necessary background in graph/geometry will be reviewed. Some knowledge of systems, signals, and probability (e.g. EE301, EE464, EE401) is required. Some background in random processes is necessary. While the theory of random processes in engineering (EE562a) is a recommended preparation, it is not a requirement.

**Text Book**
There is no nominal textbook available in this very recent subject, but the instructor will provide reading references, copies of papers, and notes.