

**Course Outline for 295B (Special Topics)—Complex Networks  
University of Vermont, Spring 2007**

**Lecture room and meeting times:**

220 Votey, Tuesday and Thursday, 12:30 pm to 1:45 pm

**Instructor:** Prof. Peter Dodds

**Office:** 203 Lord House, 16 Colchester Avenue

**E-mail:** peter.dodds@uvm.edu

**Office phone:** (802) 656-2971

**Office hours:** 2 to 3 pm, Tue; 11 am to 12 pm, Wed.

**Course website:** <http://www.uvm.edu/~pdodds/teaching/2007-01UVM-295/>

**Text:** Journal papers to be assigned.

**Synopsis:** Complex networks crucially underpin much of the real and synthetic world. Networks distribute and redistribute information, water, food, and energy. Networks can be constituted by physical pipes, embodied in relationships carried in people's minds, or manifested by economic interdependencies.

In the past decade, building on work in a wide range of disciplines, many (but certainly not all) advances have been made in understanding all manner of complex networks such as the World Wide Web, social and organizational networks, biochemical networks, and transportation networks. In this special topics course, we will explore this evolving field of complex networks by reading and discussing seminal and recent papers, and developing mathematical and algorithmic results where they exist.

The level will be graduate/advanced undergraduate.

**Topics to be covered (more or less):** Structure and form of complex networks including physical branching networks (river networks and cardiovascular networks), neural networks, social networks, the Internet, the world wide web, transportation networks, and organizations; distribution versus redistribution networks; properties of networks including degree distributions, clustering, motifs, various measures of betweenness, modularity, the role of randomness, network dynamics, and multiscale structures; community detection algorithms; bipartite networks; partly random networks as models of real world networks; generating function techniques; universal models including scale-free networks, p-star networks, and generative models; small-world networks; impedance and flow in networks; connections between delivery networks and energy usage in organisms; search in networks as facilitated by network structure and search methods; folksonomy and tagging; generalized notions of contagion in networks; network epidemiology and fad spreading; computation considerations for analysing networks.

**Prerequisites:** Familiarity with differential equations, difference equations, standard calculus, linear algebra, and statistical methods.

**Computing:** Proficiency in coding (C, Matlab, perl, python) will be beneficial (and indeed necessary) for certain projects but is not required.

**Grading breakdown:**

1. **Projects/talks (60%)**—Students will work on semester-long projects. Students will develop a proposal in the first few weeks of the course which will be discussed with the instructor for approval. A list of possible projects will be provided though individuals are encouraged and free to choose their own. Project content may range from novel research to a review of research relevant to the course. The hope here is for some work to percolate up to the level of journal publications. Students will give two brief presentations in the middle of the semester and a longer one at the end (length of talks will depend on class size). Students will also be required to hand in a report on their investigations. The grade breakdown will be 10% for the two in-term talks, 20% for the final talk, and 25% for the written project.
2. **Assignments (30%)**—All assignments will be of equal weight and there will be approximately four of them. Clarity in writing and presentation will be taken into account in grading.
3. **General attendance/Class participation (5%)**—it is highly desirable that students attend class, and class presence will be taken into account if a grade is borderline.
4. **Attendance of office hours (0%)**—students are requested to attend at least one session of office hours during the course (again, the borderline grade issue is to be kept in mind here).
5. The course is a 3 credit course and is aimed at graduates and advanced undergraduates.

**Schedule:**

<b>Week number (dates)</b>	<b>Tuesday</b>	<b>Thursday</b>
1 (1/16 and 1/18)	lecture	lecture
2 (1/23 and 1/25)	lecture	lecture
3 (1/30 and 2/1)	lecture	lecture
4 (2/6 and 2/8)	lecture	lecture
5 (2/13 and 2/15)	lecture	Project presentations <sup>†</sup>
6 (2/20 and 2/22)	lecture	lecture
7 (2/27 and 3/1)	lecture	lecture
8 (3/6 and 3/8)	Town Meeting Day	lecture
9 (3/13 and 3/15)	Spring Recess	Spring Recess
10 (3/20 and 3/22)	lecture	Project presentations <sup>*</sup>
11 (3/27 and 3/29)	lecture	lecture
12 (4/3 and 4/5)	lecture	lecture
13 (4/10 and 4/12)	lecture	lecture
14 (4/17 and 4/19)	lecture	lecture
15 (4/23 and 4/26)	lecture	Project Presentations <sup>‡</sup>
15 (5/1)	Project Presentations <sup>‡</sup>	—

†: 3 minutes each; \*: 6 minutes each; ‡: 15–20 minutes each

**Important dates:**

1. Classes run from Tuesday, January 16th to Thursday, May 1.
2. Add/Drop, Audit, Pass/No Pass deadline—Monday, January 29.
3. Last day to withdraw—Friday, March 23.
4. Reading and exam period—Friday, December 8th to Friday, December 15th.

**Do** check your zoo account for updates regarding the course.

**Academic assistance:** Anyone who requires assistance in any way (as per the ACCESS program or due to athletic endeavors), please see or contact me as soon as possible.

**Being good people:** First, in class there will be no electronic gadgetry, no cell phones, no beeping, no text messaging, etc. You really just need your brain, some paper, and a writing implement here (okay, and Matlab—see below). Those who beep will be fined one Clif Builder Bar by the instructor. Second, I encourage you to email me questions, ideas, comments, etc., about the class but request that you please do so in a respectful fashion. Finally, as in all UVM classes, **Academic honesty** will be expected and departures will be dealt with appropriately. See <http://www.uvm.edu/cs/es/> for guidelines.

**Late policy:** Unless in the case of an emergency (a real one) or if an absence has been predeclared and a make-up version sorted out, assignments that are not turned in on time or tests that are not attended will be given 0%.

**Grades:**

A+	97–100	B+	87–89	C+	77–79	D+	67–69
A	93–96	B	83–86	C	73–76	D	63–66
A-	90–92	B-	80–82	C-	70–72	D-	60–62