

## Course Content

Course Title (English)	Network Science
Course Title (Chinese)	網路科學
Credit	3
Instructor	Prof. Kwang-Cheng Chen 陳光禎 教授
Outline	<p>1.Introduction to Networks</p> <p>a)Technological networks such as Internet, communication networks, power grids, transportation networks, etc.</p> <p>b)Information networks such as WWW, citations, etc.</p> <p>c)Social networks and data mining</p> <p>d)Biological networks</p> <p>2.Introduction to Probability and Random Processes</p> <p>3.Introduction to Mathematical Statistics</p> <p>4.Random Graphs</p> <p>5.Statistical Analysis of Networks</p> <p>6.Models of Networks</p> <p>a)ER Networks</p> <p>b)Power Laws and Scale-free Networks</p> <p>c)Small-World Networks</p> <p>d)Random Geometry Graphs</p> <p>e)Network Information Theory</p> <p>7.Dynamics of Networks</p> <p>a)Percolation</p> <p>b)Search and Navigation</p>

	<ul style="list-style-type: none"> <li>c)Epidemics</li> <li>d)Information Cascading</li> <li>e)Evolution of Networks and Graphs</li> <li>f)Temporal Networks</li> <li>8.Wireless Networks <ul style="list-style-type: none"> <li>a)Stochastic Geometry and Interference Analysis</li> <li>b)Cognitive Radio Networks</li> <li>c)Large Ad Hoc Networks</li> </ul> </li> <li>9.Social Networks <ul style="list-style-type: none"> <li>a)Community</li> <li>b)Decision on Networks</li> <li>c)Inference on Networked Data</li> <li>d)Interaction Networks and Opinion Dynamics</li> <li>e)Social Learning and Systems</li> </ul> </li> <li>10.E-Commerce and Economy <ul style="list-style-type: none"> <li>a)Voting and Consensus</li> <li>b&gt;Influence and Recommender Systems</li> <li>c)Collective Behaviors and Intelligence</li> <li>d)Game Theory over Networks</li> <li>e)Market, Management, and Information</li> </ul> </li> <li>11.Biological Networks <ul style="list-style-type: none"> <li>a)System Biology</li> <li>b)Ecology and Population Dynamics</li> <li>c)Application to Wireless Communication Networks</li> </ul> </li> </ul>
Goal	<p>Although related research existed long time ago, network science has emerged as a major interdisciplinary science and technology since the pioneer papers</p>

	<p>published in Nature and Science in 1998-9. Based on mathematics (probability and statistics, random graphs) and statistical physics, network science has been proven to be useful in technological networks (e.g. Internet and the series of wireless networking papers in the IEEE journals), molecular/system biology, biochemical reactions, biology, ecology, multi-agent interaction networks, networked data analysis/mining, social networks, social systems and dynamics, network security and privacy, cyber-physical systems (e.g. smart electricity grids), epidemics, and economy.</p> <p>This multi-disciplinary course intends to orient fundamental knowledge and applications of network science, and to facilitate students' capability in the information society. The prerequisite of this course is Probability (undergraduate level after Calculus). However, the class note is self-contained to provide necessary background knowledge.</p>
English Teaching	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Teaching Material	<input checked="" type="checkbox"/> English <input type="checkbox"/> Chinese