This seminar introduces students to the fundamental technical drivers of the digital revolution and the dramatic influence of these developments on the institutions, economics and policy of mass communication. Topics include: the role of the computer and the digital representation of sound, text, images and moving images; media ergonomics, digital networks, optical technologies, the use of the electromagnetic spectrum, recent changes in motion picture, publishing, telecommunications, radio, television and online industries. This course is one of a new five-course sequence that is being reviewed by Rackham as providing a special Certification in Digital Studies for graduate students in diverse professional and academic fields at Michigan.

The seminar presumes no mathematical or technical background on the part of students; it is an introduction. But the course does focus on the underlying physics and electronics of how things work. The reason for this perspective is straightforward. If as a researcher, media professional, or policymaker one wants to understand what the technology can and cannot do – how far you can push it, what can and cannot be regulated, why some elements are expensive and others cheap, what the media will look like in ten years – one has to understand some of what is going on under the hood.

There is a wonderful scene in the first Star Wars movie -- Obi-wan and Luke are watching the hologram of Princess Leia projected into the air. Sounds like just another new technology? Photons, however, don’t do that, and won’t do that in the future; they don’t float out into the air and then suddenly decide to turn around and come back (quantum physics aside.) Maybe there was supposed to be some reflective medium I didn’t notice in that scene. When you know a little more about how things work, you have a better basis for being enthusiastic about new developments when there is good reason and appropriately skeptical about phony photons and other forms of electronic snake oil.

The seminar covers three intertwined topics – 1) how humans respond to sound, light and mediated communication 2) the components of modern media systems such as information storage, computation, transmission and display and 3) network architectures with special attention to the mother of all networks, the Internet.

The course requirement is a term paper on a topic of the student’s choosing. It is presumed that students may well have quite different motivation for studying in this area – research, an interest in policy and regulation, the media business, legal issues, design and management of media systems. Accordingly, the termpaper assignment is to apply the seminar content to topic in their own field of interest such as information security, personal privacy, community building, entertainment media, copyright or similar issues. Readings will be based on a coursepack.
Topical Outline & Reading Assignments

1. Sept 13  Introduction to the New Media
   1.1. Why Study the Technology?
   1.2. The Nature of Sound
   1.3. The Nature of Light
   1.4. The Physiology of Human Perception
   1.5. The Behavior of Electrons
   1.6. Electromagnetic Radiation and Propagation
   1.7. The Spectrum
   1.8. The Generic Properties of the New Media
      Vannevar Bush  As We May Think
      Craig Freudenrich  Light
      science.howstuffworks.com/light.htm
      Tom Harris  Hearing
      entertainment.howstuffworks.com/hearing.htm
      Carl Bianco  Vision
      science.howstuffworks.com/eye.htm
      Marshall Brain  Electricity, Radio and Spectrum
      science.howstuffworks.com/electricity.htm
      electronics.howstuffworks.com/radio-spectrum.htm
      electronics.howstuffworks.com/radio.htm
      W. Russell Neuman  The Generic Properties of the New Media

2. Sept 20  Capturing Sound and Light
   2.1. Alphanumeric Systems
   2.2. Edison’s Phonograph
   2.3. Photographic Fundamentals
   2.4. Motion Pictures
   2.5. Television Imaging
   2.6. Digital Imaging
   2.7. Enter Digital: Pulse Code Modulation
      Stephen Littlejohn  Theories of Signs and Language
      Marshall Brain  Analog and Digital Recording, Television
      electronics.howstuffworks.com/analog-digital.htm
      electronics.howstuffworks.com/cassette.htm
      entertainment.howstuffworks.com/tv.htm
      Charles Woodworth  Photography
      science.howstuffworks.com/film.htm
      Jeff Tyson  Motion Pictures
      www.howstuffworks.com/movie-projector.htm
      Karim Nice Gerald Jay Gurevich  Digital Imaging
      electronics.howstuffworks.com/digital-camera.htm
      Hermann Helgert  Pulse Code Modulation
3. Sept 27 Transmission Technologies
   3.1. The Model of Communication
   3.2. Telegraph
   3.3. Telephone
   3.4. AM Radio
   3.5. FM Radio
   3.6. Television Transmission
   3.7. Cable Television
   3.8. Satellite Broadcasting
   3.9. Data Communication
   3.10. Optical Fiber
       Tom Perera Telegraphy
       www.chss.montclair.edu/~pererat/pertel.htm
       Marshall Brain Telephony and, Television
       electronics.howstuffworks.com/telephone.htm
       electronics.howstuffworks.com/tv.htm
       Curt Franklin Cable Television
       entertainment.howstuffworks.com/cable-tv.htm
       Karim Nice and Tom Harris Satellite Broadcasting
       electronics.howstuffworks.com/satellite-tv.htm/printable
       Ray Horak Fundamentals of Data Communication
       Craig Freudenrich Optical Fiber
       electronics.howstuffworks.com/fiber-optic.htm

4. Oct 4 Storage & Display Technologies
   4.1. Paper and Printing
   4.2. Magnetic Tape
   4.3. CDs and DVDs
   4.4. ROM and RAM
   4.5. Speakers
   4.6. Cathode Ray Tubes
   4.7. Plasma, LCDs and DLPs
       David Macaulay Paper and Printing
       Marshall Brain CDs
       entertainment.howstuffworks.com/cd.htm
       Karim Nice DVDs
       entertainment.howstuffworks.com/dvd.htm
       Jeff Tyson ROM, RAM and LCDs
       computer.howstuffworks.com/rom.htm
       computer.howstuffworks.com/ram.htm
       electronics.howstuffworks.com/lcd.htm
       Tom Harris Speakers, Plasma Displays
       electronics.howstuffworks.com/speaker.htm
       electronics.howstuffworks.com/plasma-display.htm
       Craig Freudenrich DLPs
       electronics.howstuffworks.com/projection-tv.htm
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5. Oct 11  **Signals and Systems**  
5.1. Fourier  
5.2. Frequency response  
5.3. Filters  
5.4. Digital filtering  
    Zover Karu *Signals and Systems Made Ridiculously Simple*

6. Oct 25  **Information Theory & Digitization**  
6.1. Modeling a communications channel (coding, noise, decoding)  
6.2. Measuring information  
6.3. Channel capacity: Shannon's theorem  
6.4. Digitization & Nyquist's theorem  
6.5. Lossless Source Coding  
6.6. Predictive Coding  
6.7. Frequency Domain Coding  
    Claude Shannon, Warren Weaver *The Mathematical Theory of Communication*  
    Fred Dretske *Communication Theory*

7. Nov 1  **Networks**  
7.1. Circuit Switching  
7.2. Packet Switching  
7.3. The ISO Layering Model & the CSTB hourglass  
7.4. Flow Control/Access control  
7.5. Latency  
7.6. Error Detection  
7.7. Queuing  
    Frank Defler, Les Freed *How Networks Work*

8. Nov 8  **The Internet**  
8.1. TCP/IP  
8.2. Addresses and Domains  
8.3. Routers  
8.4. HTTP  
8.5. Multicast IP  
8.6. Dynamic Scripting  
8.7. Email  
    Preston Gralla *How the Internet Works*  
    Sharon Gillett Eisner, Mitchell Kapor *The Self-Governing Internet*  
    Marjorie Blumenthal, David Clark *Rethinking the Design of the Internet*
9. Nov 15 Wireless Communications  
   9.1. Cellular systems: First, second, third generation  
   9.2. Wireless data  
   9.3. Spectrum policy, competition & innovation  
      George Calhoun The Cellular Idea  
      Ray Horak Wireless Networking  

10. Nov 22 The Technical Standards Wars  
   10.1. The Economics of Standards Setting  
   10.2. The Politics of Standards Setting  
   10.3. The Dynamic Process  
   10.4. Standards Institutions  
      Susanne Schmidt, Raymund Werle Coordinating Technology  
      Joseph Farrell, Garth Saloner The Economics of Horses, Penguins and Lemmings  

11. Nov 29 Data Security & Cryptography  
   11.1. Authentication (Passwords, tokens, biometrics)  
   11.2. Confidentiality (encryption)  
   11.3. Integrity (error correction, digital signatures)  
   11.4. Non-repudiation (digital signatures)  
   11.5. Transposition  
   11.6. One-way function: Hash Functions  
   11.7. Symmetric encryption: Secret Keys  
   11.8. Asymmetric encryption: Public Keys and PKI  
   11.9. Digital Signatures  
      Chey Cobb Cryptography Basics  
      Simpson Garfinkle Digital Identification Techniques  

12. Dec 6 Digital Rights Management  
   12.1. The Legal Tradition of Copyright  
   12.2. The Broadcast Flag  
   12.3. Peer to Peer Challenges  
   12.4. Containment Technologies  
   12.5. Globally Unique Identifiers  
      Randall Davis et al. Intellectual Property in the Information Age  

13. Dec 13 Wrap Up & Review
Resource Readings


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